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PAPERS

PROCEEDINGS

OF THE

Hawaiian Entomological Society

Vol. VIII, No. 1 For the Year 1931 Nov., 1932

JANUARY 8, 1931

The 300th regular meeting of the Hawaiian Entomological Society was held at the Experiment Station of the Hawaiian Sugar Planters' Association at 2:30 p.m., January 8th, 1931.

In the absence of the President and Vice-President, Mr. O. H. Swezey acted as chairman. Other members present were: Messrs. Au, Bryan, Ehrhorn, Fullaway, Ito, Keck, Rosa, Sakimura, Stanley, Van Zwaluwenburg, Wilder and Williams. Two visitors: Miss Dobroscky and Miss Suehiro.

The minutes of the previous meeting were read and approved.

The Chairman appointed Mr. Ehrhorn to audit the Society's accounts for 1930.

Mr. Bryan reviewed the list of common names of insects in Hawaii. The list, which is not yet final, induced considerable discussion.

Mr. Swezey spoke of the Trail and Mountain Club hike up Mt. Kaala on Sunday, January 11, as offering opportunity for entomologists.

Miss Dobroscky spoke of the New York Entomological Society, of which she has been a member s[illegible] 1926.

PAPERS

"Thrips tabaci Imported From Oregon." *

BY K. SAKIMURA.

NOTES AND EXHIBITIONS

Megamelus proserpina Kirk.—Mr. Fullaway spoke of the taro leafhopper as being very abundant in a limited area in some of

* Not available for publication [Ed.]

the Waianae homesteads. The homesteaders complained of their ravages. All the female leafhoppers were the short-winged form.

Cremastus hymeniae Viereck.—Mr. Swezey reported as an addition to the list of hosts of this parasite *Genophantis leahi* Swezey, whose caterpillars feed on Euphorbia. He had collected four caterpillars on a Euphorbia bush in Iao Valley, Maui, Sept. 11, 1930. Two of these caterpillars yielded, each, one of these parasites.

Chrysopa lanata Banks.—A specimen of this lacewing fly was exhibited by Mr. Swezey, who had reared it from a larva found eating the eggs of *Spodoptera mauritia* on a leaf of *Ficus macrophylla* at the Kamehameha School grounds, Honolulu, Dec. 11, 1930. The larva grew rapidly, feeding on these eggs, and spun a white spherical cocoon Dec. 18. The adult issued Dec. 31. On two or three other occasions the larvae of this species have been found feeding on *S. mauritia* eggs. The larva does not cover itself with debris or insect remains.

Holcobius glabricollis Perkins.—Specimens of this ptinid beetle were exhibited by Mr. Swezey, who had reared twenty-one of them from a dead branch of koa tree from the planted koa forest on Sugar Loaf Hill, Nov. 4, 1930. From some of their larvae, specimens of a Sclerodermus were reared, which is apparently a new species.

Pseudococcus citricolus Green.—Mr. Ehrhorn spoke of finding a mealybug on a lime tree in Manoa Valley which has been identified as this species. It is the first record of its occurrence in the Hawaiian Islands.

Volucella pusilla Macquart.—Mr. Ehrhorn reported finding this species of syrphid fly very abundant on flowers of *Montanoa bipinnatifida,* in Manoa Valley, Dec. 21, 1930, in company with *V. obesa.*

Volucella pusilla Macq.—Dr. Illingworth also reported this recently introduced syrphid abundant, feeding on the flowers of Bidens in a vacant lot in Kaimuki, Dec. 12, 1930. This species was first discovered in the islands by Mr. J. S. Rosa Oct. 30, 1930, at Waipahu.

Dr. Gerrit Wilder reported on collecting a drowned specimen of this fly in swimming pool Nov. 20, 1930.

Volucella pusilla Macquart.—Mr. Bryan reported finding this new fly very abundant at the University of Hawaii campus, Dec. 6, about the blossoms of *Nothopanax cochleatum*, in company with *Lathyrophthalmus arvorum*, *Volucella obesa*, *Stomorhina pleuralis*, *Milichiella lacteipennis*, *Chrysomyia megacephala*, Pachodynerus wasps, and honey bees. The blossoms of Golden dewdrop (*Duranta repens*) near by, were attracting the honey bees and Pachodynerus wasps, but not the flies. The insects were eagerly sucking nectar from the opening blossoms.

Mr. Keck reported having seen what was undoubtedly this fly in September, 1930, on Chinese Orange in Honolulu.

Flies from Laysan Island.—Mr. Bryan exhibited specimens of four species of Diptera collected on Laysan Island by Gerrit P. Wilder, August, 1930. The species were:

Scatella sexnotata Cresson
Lucilia graphita Shannon
Undetermined sarcophagid
Undetermined stratiomyid

All four species have been previously recorded from Laysan, (Bryan, B. P. Bishop Museum Bulletin 31, 1926).

Cryptolaemus montrouzieri Mulsant.—Mr. Bryan exhibited a leaf of the Hawaiian wiliwili (*Erythrina monosperma*) from the University of Hawaii campus, having on it pupal cases of this ladybeetle, and the newly emerged beetles. The cases consist of the dry larval skins, which are white and waxy, much resembling the mealybugs on which the beetles prey.

Caryoborus gonagra Fabr.—Mr. Bryan reported finding this bruchid beetle in a flower of *Sesbania grandiflora* var. *coccinea*, December 6th, on the University of Hawaii campus.

Mylabris limbatus (Horn).—Mr. Bryan reported finding this bruchid beetle in the pods of *Wallaceodendron celebicum*, the banuyo legume, on the University of Hawaii campus, December 6th.

Mosquitoes in Hawaii.—Mr. Bryan stated that he had been told by Mr. David M. Forbes of Waimea, Hawaii, that in 1890, when

he, Forbes, had first gone to the Kukuihaele Plantation in Hamakua, Hawaii, there had been no mosquitoes in that region. He said that they had arrived a few years later, and had become quite abundant.

Mr. Forbes also related the following anecdote, which he had heard secondhand from an old Hawaiian living in Waimea, Hawaii, but which is at least suggestive as to human aid in insect distribution. The story goes that sometime about 1860, a sailor from some vessel anchored at Kawaihae had had a sweetheart living in Waimea. When it came time for him to leave, he gave her a parting gift to remember him by, with instructions that she was not to open it until his ship had put to sea. When she opened the little bag which the parcel contained, out jumped several little uku. And that is how the flea, which is still so abundant in the region, first came to Waimea.

Galleria mellonella (Linn.)—Dr. Wilder reported having reared this moth from comb in beehive, Dec. 3, 1930. Moth, cocoons and chrysalis were exhibited. The other bee moth, *Meliphora grisella* (Fabr.) was also reared at the same time. This appears to be the first record of *Galleria mellonella* in the Hawaiian Islands.

FEBRUARY 5, 1931

The 301st regular meeting of the Hawaiian Entomological Society was held at the Experiment Station of the Hawaiian Sugar Planters' Association, on February 5, 1931, at 2:30 p.m.

Members present were: Messrs. Bianchi, Bryan, Carter, Ehrhorn, Fullaway, Hagan, Illingworth, Marlowe, Mason, McBride, Mitchell, Rosa, Swezey, Van Zwaluwenburg and Williams. Visitors present: A. J. Smith and W. H. Volck.

President Mason called the meeting to order.

The minutes of the previous meeting were read and approved.

Mr. Ehrhorn stated that he had audited the Society's accounts for 1930 and found them to be correct.

Upon being called upon, Mr. Volck of the California Spray Chemical Company made a few remarks.

NOTES AND EXHIBITIONS

Engytatus geniculatus Reuter.—Dr. Illingworth reported this mirid bug feeding and breeding in the flowers of tomatoes at Kaimuki. Both nymphs and adults were observed in abundance sucking on the anthers of the flowers, causing these organs to dry up. As a result few of the fruits set. A mosaic disease was evident on the leaves of the plants, and also on peppers adjoining. As far as observed, these bugs were the only sucking insects present, and possibly are the vectors.

This led to a considerable discussion on insects as transmitters of yellows, mosaic and other virus diseases.

Haplogonatopus vitiensis Perk.—Mr. Swezey reported that twenty-six cocoons of this dryinid were collected from taro leaves at Waianae, January 13, where the parasite had bred on the taro leafhopper, *Megamelus proserpina* Kirk. From these cocoons, eight of the dryinid and thirteen *Saronotum americanum* Perkins had issued.

Cyrtorhinus mundulus (Bredd.).—Mr. Swezey reported this bug as occurring abundantly on the taro leafhopper in Waianae. There were adults, nymphs and also the eggs in the petioles of the taro. A Polynema issued from some of these eggs, apparently the same species (*reduvioli*) that has been reared from eggs of Reduviolus. Possibly there was a Reduviolus egg among the Cyrtorhinus eggs. *Reduviolus capsiformis* (Germ.) was observed on the taro.

Scelio sp.—Mr. Swezey exhibited numerous living examples of a Scelio reared from grasshopper eggs (Oxya sp.) received from Mr. Pemberton, sent from Serdang, Selangor, Federated Malay States. Five consignments of parasitized eggs had been received from Mr. Pemberton, and from them several hundred Scelio had issued, 600 of which have been liberated in favorable places for them to find Oxya eggs for oviposition. Others are being retained in attempts to rear them.

Protoparce quinquemaculata blackburni (Butl.).—A caterpillar of the Hawaiian tobacco worm was exhibited by Mr. Swezey. He had collected two of them on a tobacco plant growing wild at the mouth of Kaneana Cave, Makua, Oahu, January 25, 1931. This insect has seldom been collected on Oahu, though quite common

on Maui and Molokai. It was the first time that he had collected it on Oahu.

Oopsis nutator (Fab.)—Mr. Swezey reported having reared nine of this longicorn beetle from a dead Pipturus tree from Manoa Valley, Dec. 28, 1930. It apparently had not been recorded from that tree previously. Previous records have been from hau and kukui.

Ancristus ceroplastae How.—Mr. Swezey reported this aphelinid from *Coccus hesperidum,* from which apparently it had not been previously recorded in Hawaii. Sixty of the parasites had issued from a small infestation of *Coccus hesperidum* Linn. on papaia fruit. The material had been handed in Jan. 12 by Mr. Ehrhorn, who had received it from Mr. Ambrose of the Kamehameha Schools. The papaia had grown on the Kamehameha school farm in Hahione Valley near Koko Crater.

Aenasia sp.—Mr. Fullaway exhibited specimens of *Aenasia* sp., parasitic on the pineapple mealybug. He spoke of this encyrtid and the Mexican hemerobiid, sent in by Mr. Rust, as being to all appearances now established here. He exhibited also a Hippoboscid fly, an ectoparasite on pheasants here. The taro leafhopper Megamelus at Waianae was also mentioned and rather widely discussed. Mr. Swezey added that *Cyrtorhinus mundulus,* the egg-sucking bug of the sugar cane leafhopper, occurred in all stages among these taro leafhoppers, upon the eggs of which it undoubtedly fed. Mr. Fullaway further mentioned finding the lady beetle *Curinus coeruleus* resting on the fruit of noni (*Morinda citrifolia*) at Waianae, and Mr. Bryan spoke also of finding this beetle resting in groups. Its host did not appear to be present in either case.

Mr. Bryan spoke of a fine relief map of Oahu, the work of Mr. Haas, Government engineer, as being on exhibit at the Bishop Museum. Here also was mentioned the fact that *Nesithmysus haasii,* a rare and handsome native longicorn beetle, was named in honor of Engineer Haas, its discoverer.

At Dr. Carter's invitation, Monday, Feb. 9, at 4:00 p.m., was set aside for an entomological visit to the new virus building of the Association of Hawaiian Pineapple Canners.

The Executive Committee announced the appointment of the following officers for 1931:

O. H. Swezey—Editor.
J. S. Rosa—Librarian.
F. X. Williams—Curator of Collections.

MARCH 5, 1931

The 302nd regular meeting of the Hawaiian Entomological Society was held at the Experiment Station of the Hawaiian Sugar Planters' Association, on March 5, 1931.

Members present as follows: Messrs. Bianchi, Bryan, Ehrhorn, Fullaway, Hagan, Keck, Mason, McBryde, Rosa, Swezey, Van Zwaluwenburg, Watt, Weinrich, Wilder, Willard, and Williams.

President Mason called the meeting to order.

The minutes of the previous meeting were read and approved.

NOTES AND EXHIBITIONS

Mr. E. H. Bryan gave a very interesting talk (to be published elsewhere in detail) on his recent visit to the barren island of Kahoolawe, from Feb. 13-19. He made extensive collections of plants and insects and took many photographs. A strong wind sweeps over the island. Two boxes of Kahoolawe insects were shown. Much discussion intervened and followed.

Coptotermes formosanus Shiraki.—Mr. D. T. Fullaway spoke of the spread of this termite to Lanai landing.

Draeculacephala mollipes (Say) on Maui.—Mr. Van Zwaluwenburg reported seeing an adult of this species on grass at Olowalu, Maui, Feb. 19, 1931. This appears to be an addition to its known distribution in these Islands.

Heterocrossa olivaceonitens Walsm.—A series of thirty-seven of this pretty green-marked moth was exhibited by Mr. Swezey who had reared them from about three dozen Sideroxylon fruits picked up in the dry stream bed in Makaleha Valley, Waianae Mts., Feb. 1, 1931. It has previously been reared from the same fruit from various places on Oahu, and also from Clermontia buds and fruit. It occurs also on Kauai, Maui and Hawaii.

Litomastix floridana (Ashm.)—Mr. Swezey exhibited a caterpillar of *Plusia chalcites* parasitized by this tiny parasite, which had been collected on *Solanum nodiflorum,* a weed in a fallow pineapple field on Kunia road Feb. 19, 1931. This is the farthest from Honolulu that this parasite has been recovered.

Aphis middletonii Thomas.—Mr. Swezey reported finding this root-inhabiting aphis on roots of *Bidens pilosa, Solanum nodiflorum* and *Elusine indica* in fallow pineapple fields of Waipio and Kunia, Feb. 19, 1931. These are new host-plant records for this aphid in the Hawaiian Islands.

Dr. Williams reported on two immigrant Psocidae identified by Nathan Banks in 1930. These are:

Psocathropus lachlani Ribaga, taken in 1927 and 1928 in Honolulu by O. H. Swezey; and *Psoquilla marginepunctata* Hag., taken in 1918 in Honolulu by O. H. Swezey and in 1925 at Kualoa, Oahu, by G. A. McEldowney. To quote, in part, Mr. Bank's letter of Aug. 6, 1930: "There are two very good things both described from Europe in hothouses; the Psoquilla has been found in various parts of the tropics, the Psocathropus in Italy, Africa and now with you; a very similar form is in Florida".

Pantala flavescens (Fab.)—Dr. Williams also exhibited two living nymphs of our common dragon fly. These nymphs are often abundant in very shallow water of ditches and marshes where the temperature feels almost tepid to the touch. He called attention to their protective coloration. They breathe by means of rectal gills.

Ethmia colonella Walsm.—This moth, that defoliates the native "Kou," *Cordia subcordata* Lam., was discussed and the question arose that, since one now seldom sees large specimens of this "Kou", whether Ethmia was not responsible for the commonly stunted condition of these trees and if it was not to be considered an introduced insect.

Mr. Swezey spoke of having received a publication in German on the life of Albert Koebele.

The subject of a picture of the late Mr. W. M. Giffard came up and Mr. G. P. Wilder kindly volunteered to procure one, if possible, for the Society.

APRIL 2, 1931

The 303rd regular meeting of the Hawaiian Entomological Society was held at the Experiment Station of the Hawaiian Sugar Planters' Association, on April 2, 1931, at 2:30 p.m.

Members present as follows: Messrs. Bryan, Carter, Chapman, Ehrhorn, Fullaway, Ito, Keck, Mason, Rosa, Sakimura, Van Zwaluwenburg and Williams.

Visitors: Dr. Irene D. Dobroscky, Miss Amy Suehiro and Mr. T. M. Blackman.

President Mason called the meeting to order.

The minutes of the previous meeting were read and approved.

Dr. Wilder mentioned having secured a photograph of the late Mr. W. M. Giffard.

PAPERS

Mr. D. T. Fullaway read the titles of two papers now in preparation by him—as follows:

"Synopsis of the Hawaiian Diaspinae."

"Hymenopterous Parasites of Coccidae, etc., in Hawaii."

Dr. Williams read by title a paper by J. Meikle Brown—as follows:

"A New Species of Proisotoma (Order Collembola) from India."

NOTES AND EXHIBITIONS

Nesithmysus haasii Perkins.—A fine specimen of this cerambycid beetle was exhibited by Mr. Swezey who had reared it from a larva found in a *Pelea clusiaefolia* tree on the U. S. Engineers' trail from Wahiawa to Waikane. The locality was just over the crest on the Waihawa side of the Koolau Range, and probably within a mile of where the type specimen was collected on the same trail July 4, 1920. The only other specimen ever collected was by Dr. Williams, July 21, 1929, on the top of Mt. Kaala. This is the first time it has been reared, and determines its host tree to be Pelea, the same as for all of the other species of Nesithmysus that are known.

Two specimens of *Nesithmysus bridwelli* Perkins were reared also from grubs obtained in the same tree as the above.

Oxacis collaris Shp.—A specimen of this oedemerid beetle was exhibited by Mr. Swezey, who had collected it from a young cane shoot at Kawela, Molokai, Mar. 23, 1931. The first record of its occurrence on that Island.

Ananca sinensis Gemm. (?)—A specimen of this oedemerid beetle was exhibited by Mr. Swezey. He had collected it at light at Mapulehu, Molokai, Mar. 21, 1931. The first record of its capture on Molokai.

Kelisia paludum Kirk.—A specimen of this delphacid leafhopper was exhibited by Mr. Swezey, who had captured it in swamp (swept from a small sedge) at Mapulehu, Molokai, Mar. 20, 1931. Several nymphs were also obtained. It is the first record of its occurrence on Molokai.

Lathyrophthalmus aeneus (Scop.) — Mr. Swezey reported catching one of these syrphid flies at light at Mapulehu, Molokai, March 21, 1931. It is the first record of its occurrence on that Island.

Mr. E. H. Bryan, Jr., exhibited some beetles from New Guinea.

Virus diseases—chiefly on plants, were discussed by Drs. Dobroscky, Chapman, Carter, Messrs. Fullaway and others.

Dr. Carter reported on the long-postponed virus trip that took place on February 19. It was replete with interesting discoveries re mosaic and other diseases on various weeds. Considerable discussion followed. Only five persons (all entomologists) went on this trip.

Following a discussion on the corn ear worm (*Heliothis obsoleta*) which has done much damage to corn here during the last year, Mr. Fullaway spoke of the larger quantities of fresh vegetables coming from the Pacific coast in recent years and hence the danger from insect pests from these sources.

Acting upon a motion made at the beginning of the meeting by Mr. Fullaway and seconded by Mr. Bryan, that a committee be appointed to secure and assemble photographs of members of the Hawaiian Entomological Society, particularly of the older members, President Mason appointed Messrs. Ehrhorn, Fullaway and Swezey as the members of that committee.

MAY 7, 1931

The 304th regular meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., on May 7, 1931, at 2:30 p.m.

Members present as follows: Messrs. Bryan, Crawford, Ehrhorn, Fullaway, Hagan, Illingworth, Keck, Mason, Mitchell, Rosa, Swezey, Van Zwaluwenburg, Wilder and Williams.

Visitor—Mr. T. M. Blackman.

President Mason called the meeting to order.

The minutes of the previous meeting were read and approved.

Mr. Swezey announced that the Proceedings of the Hawaiian Entomogolical Society VII, No. 3, for the years 1929-1930 were now published and available.

Mr. Bryan presented a MS. of the index for Vol. VII, of the Proceedings. The Society expressed its appreciation of the work of Editor O. H. Swezey and Mr. E. H. Bryan, Jr., for their painstaking work.

Mr. Bryan presented the Society with a large container for photographs of members of the Society.

PAPERS

Mr. Swezey presented a paper entitled

"The Host Trees of the Endemic Cerambycidae in Hawaii" and gave a brief résumé of it.

On behalf of Dr. F. Muir he presented a book review entitled **"The Biological Control of the Coconut Moth** (*Levuana iridescens* Beth-Baker) **in Fiji,"** by Messrs. J. D. Tothill, T. H. C. Taylor and R. W. Paine.

NOTES AND EXHIBITIONS

Enchytraeus silvestris Bretsch.—Mr. Swezey reported that he had recently received a card from Dr. Michaelsen, of Hamburg, giving this as possibly the name of a tiny worm sent him. The worms were from soil about seed cane, Puunene, Maui. They also were in the decaying seed cane and rotten leaf sheaths attached.

Heterocrossa atronotata Walsm.—A specimen of this moth was exhibited by Mr. Swezey, who had reared it from a larva collected on leaves of Vaccinium, Puu Kalena, Waianae Mountains, April 19, 1931. The species was described on a single specimen from the top of Haleakala, Maui, and this is the first time it has been collected since. It is very close to *H. inscripta,* which has been reared from Ohelo berries (*Vaccinium reticulatum*) at Kilauea, Hawaii.

Gitonides perspicax Knab.—Mr. Swezey reported rearing this fly from Cenchrus grass infested with *Trionymus insularis* collected at Kanoa, Molokai, April 27, 1931. It had not previously been recorded from Molokai.

Marietta graminicola Timb.—Mr. Swezey reported rearing this secondary parasite from *Trionymus insularis* Ehr., swept from Bermuda grass at Mapulehu, Molokai, March 20, 1931. The parasite issued April 17. It had not been recorded from Molokai previously.

Nesithmysus haasii Perkins.—A series of 12 of this cerambycid beetle was exhibited by Mr. Swezey, who had reared them from larvae in Pelea trees collected at the top of the ridge above Kahana Valley, February 9, 1931.

Hyposmocoma n. sp.—Mr. Swezey exhibited two moths that had issued from cases amongst lichens on koa tree, Tantalus. Miss Suehiro sent them in for exhibition. The larval cases were covered with bits of the lichen so as to resemble a part of the much-branched lichen to which they were fastened. The species is apparently undescribed, and related to *nigralbida* from Kauai.

Cryptorhynchus mangiferae (Fab.).—Mr. Swezey reported having found a larva of this weevil in seed of mango at Kawela, Molokai, April 27, 1931. It is apparently the first record of this insect on Molokai.

Mr. Bryan spoke of Prof. J. Chester Bradley's "Manual of Beetles of North America" as a very useful book. It is lithoprinted.

Ceratitis capitata Wied.—Dr. Illingworth said that at the present time fruit flies were quite bad. Mangoes particularly were affected. Host immunity was discussed by several of the entomologists present.

Anagyrus sp.—Dr. Williams said that the Anagyrus wasp, parasitic on the pink sugar cane mealybug and sent from the Philippines by F. C. Hadden was established, having been recovered from mealybugs on cane at the Honolulu Plantation Company on April 16 by Mr. Swezey and himself, and also recently recovered on cane at the H.S.P.A. Experiment Station grounds.

The flights of termites were discussed by Mr. Ehrhorn and others.

JUNE 4, 1931

The 305th regular meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., on June 4, 1931, at 2:30 p.m.

Members present: Messrs. Bryan, Carter, Ehrhorn, Fullaway, Illingworth, Marlowe, Mason, McBride, Pemberton, Rosa, Swezey, Wilder and Williams.

Visitors: A. J. Smith, T. M. Blackman, Amy Suehiro.

President Mason called the meeting to order.

The minutes of the previous meeting read and approved as corrected.

The Secretary reported a meeting of the Executive Committee held on May 26 at 2:30 p.m., all the members of the Committee being present. The bill for $892.00 for publishing Vol. VII, No. 3, 1929-1930 of the Proceedings of the Hawaiian Entomological Society was discussed and Mr. Fullaway made a motion, seconded by Dr. Chapman, that the Society pay $250.00 from its funds toward defraying this bill. The motion was passed. An item for $16.00 for separata was also approved.

The Secretary then presented resolutions in regard to the death of Dr. F. A. G. Muir.

"*WHEREAS*, in the death of Dr. F. A. G. Muir, at his home in England, on May 13, 1931, the Hawaiian Entomological Society has lost one of its most devoted members, and

"*WHEREAS*, Dr. Muir, one-time president of the Society, taking the deepest interest in its welfare, faithful in attendance at the meetings, always ready to participate in the discussions, and

DR. FREDERICK A. G. MUIR

contributing valuable papers for publication in the Proceedings, and

"*WHEREAS,* he has always had the keenest interest in the furtherance of knowledge of the Hawaiian insect fauna, and in addition, being a world authority on the Fulgoroidea, as well as possessing a wide knowledge in other departments of entomology, while in his official capacity he has by his notable discoveries and importations of insect enemies of pests of the sugar cane, saved the sugar planters of Hawaii from great losses, *therefore*

"*BE IT RESOLVED,* that the Hawaiian Entomological Society hereby expresses its appreciation of his interest and participation in its affairs and his valuable work for the sugar industry, and records the grievous loss it has suffered in the passing of Dr. Muir, and

"*BE IT FURTHER RESOLVED,* that a sketch of Dr. Muir's participation in entomology in Hawaii be prepared for publication in the Proceedings of the Society, and that a copy of these resolutions be sent with our expression of deep sympathy to the bereaved family".

Dr. Wilder moved that these resolutions be adopted and placed on the minutes of the meeting. Seconded by Mr. Swezey and passed, and it was voted that a signed copy of these resolutions be sent as a message of condolence to Mrs. Muir. This was done.

Mr. Swezey offered to supply a biographical sketch of Dr. Muir. (See page 141 of this issue.)

Dr. Illingworth nominated Mr. Arthur J. Smith, 2468 Kuhio Street, for membership in the Society.

President Mason nominated Mr. T. H. Hong and K. H. Lau, both of the Entomological staff of the U. S. Department of Agriculture here, for Junior membership.

NOTES AND EXHIBITIONS

Mr. Bryan read a letter from Mr. Adamson which showed the progress in the Entomological survey of the Pacific.

Mr. Pemberton gave an interesting account of his experiences in Malaya.

Dr. Carter outlined, by the help of a Latin square diagram, an

experiment in thrips control for yellow spot disease in a pineapple area of eight acres. Dusting with tobacco gave 70% control.

Mr. Swezey mentioned nereid worms—ordinarily marine organisms—being found in some decayed taro at Punaluu. They were not considered to be the cause of the decay.

Mr. Ehrhorn gave, in part, a résumé translated from a German paper, on the life of Albert Koebele.

Coccotrypes dactyliperda (Fab.)—Mr. Swezey reported having collected this scolytid at Kohala, Hawaii, where it was boring in the seeds of a palm at the Kohala Club, May 13, 1931. He also collected it at Olaa, Hawaii, May 20, 1931, where it was boring the seeds of *Dictyospermum album* and *Livistona chinensis*. These were the first records of the occurrence of this beetle on the island of Hawaii.

Enochrus nebulosus (Say).—Dr. Williams exhibited this common hydrophilid beetle found in shallow water of the lowlands. It had been determined by Dr. Van Dyke as *Enochrus nebulosus* (Say), a widely distributed species. It seems first to have been taken here in 1914 by Mr. Swezey, but had remained unidentified until May, 1931.

JULY 2, 1931

The 306th regular meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., on July 2, 1931, at 2:30 p.m.

Members present: Messrs. Bianchi, Bryan, Chock, Ehrhorn, Hagan, Illingworth, Keck, Mason, McPhail, Mitchell, Pemberton, Rosa, Van Zwaluwenburg, Wilder, Williams and Weinrich.

Visitor: Miss Amy Suehiro.

The minutes of the previous meeting were read and approved.

Arthur J. Smith, T. H. Hong and K. H. Lau were duly elected to membership.

Dr. Illingworth made a motion, seconded by Mr. Pemberton, that the bill of $189.45 for printing the thirty-two page Index for Vol. VII of the Proceedings of the Hawaiian Entomological Society be paid.

Mr. Van Zwaluwenburg made a motion, seconded by Mr. Ehrhorn, that the Secretary, in behalf of the Society, be instructed to write a letter of thanks to the trustees of the Hawaiian Sugar Planters' Association for their valuable financial aid in the publishing of Vol. VII, Proceedings of the Hawaiian Entomological Society.

Dr. Hagan gave an interesting account of the meeting in June, at Pasadena, of the Pacific Slope Branch of the American Association of Economic Entomologists.

NOTES AND EXHIBITIONS

Euscepes batatae Waterhouse.—Mr. Bryan exhibited specimens of this sweet potato weevil from a giant native specimen of sweet potato, u'ala, of the variety Mauna Pohaku, which weighed 16 pounds when fresh, grown by J. W. Kauwenui, at Laupahoehoe, Hawaii. The sweet potato was brought to B. P. Bishop Museum, July 2, 1931, by E. S. C. Handy.

Samoan insects.—Mr. Bryan exhibited three trays full of Samoan Orthoptera and Coleoptera, which were part of a collection made by D. T. Fullaway on the island of Tutuila, in February and March, 1930. The specimens had been mounted, labelled, sorted into groups, and many of the species identified, by Miss Amy Suehiro of the Pacific Entomological Survey Staff, at Bishop Museum.

Tachysphex fusus Fox.—Dr. Williams exhibited a fresh specimen of this little larrid wasp, that has the tip of the abdomen reddish. It was caught on the margin of Field 4 B, Waianae Sugar Plantation, Oahu, on June 5, 1931. This insect is common and widespread in the United States, where it provisions its shallow burrows, made in soil, with the young of short-horned grasshoppers. As the sugar cane grasshopper (*Oxya chinensis*) is abundant in parts of Waianae, the wasp probably preys on it.

Chalybion caeruleum (Linn.)—Dr. Williams exhibited a large fresh male specimen of this brilliantly steel-blue sphecid wasp taken June 8, 1931, at a lanai (porch) window in Woodlawn, Honolulu. It uses the cells of Sceliphron (black and yellow mud-daubers) for its nest, storing them with spiders. It is common in the United States.

Telmatoscopus albipunctatus (Will.).—Dr. Williams reported on the identification of this large psychodid fly that holds its wings flat or horizontally. It was first taken about Honolulu in 1929 and where it is now common. Its early stages are passed in water or very wet mud, in tree holes, etc. This fly was sent to Dr. Guy Marshall, for identification, who writes that it is widely distributed in the Tropics. It was described in 1893, as *Psychoda albipunctata* Williston from Havana, Cuba.

Philippine weevils in the fruits of wild figs.—Dr. Williams exhibited a collection of weevils which had been referred to Dr. Marshall for identification, and had been determined chiefly by Dr. Heller, an authority on this group. The weevils are mostly of the genus Balaninus, but the genera Metarchus, Pleurotyges, Tropibalaninus and Mecopus were also represented.

There were fifteen species of these weevils in the collection.

Agrion.—Dr. Williams exhibited also a specimen of a damsel fly which passed through its life-cycle in almost exactly three months. The egg was secured in a stream on Tantalus.

JULY 27, 1931

A special meeting of the Hawaiian Entomological Society was held at the H.S.P.A. Experiment Station at 3:00 p.m., July 27, 1931, in honor of Dr. F. S. Bodenheimer, visiting from Palestine.

Members present: Messrs. Bianchi, Bryan, Carter, Chapman, Chock, Hong, Illingworth, Ito, Keck, Mason, McBride, McPhail, Mitchell, Pemberton, Sakimura, Van Zwaluwenburg, Weinrich and Williams.

Visitors present: Dr. Bodenheimer, Mrs. Cassidy, Messrs. Lau and Kamito, and Miss Suehiro.

President Mason called the meeting to order.

Dr. Bodenheimer gave a very interesting talk on the principles of population movements among insects—what caused epidemics among insects and what suppressed them. This centered in a study of insects in relation to their environment—Ecology.

The factors limiting insect life were considered. Physical factors were here generally considered more effective than control by predators and parasites.

Generally speaking, food supply is not the real limiting factor —as there is usually more than enough for all. Nor is struggle for existence thus effective, because insect mortality is heaviest in the early stages—before there would be competition.

As regards parasitism, at least in countries with well-marked seasons—there is a heavy winter mortality among insects, and parasites must make a new start each year—hence there would be no cumulative effect on pests from year to year.

Climatic factors—Temperature and humidity were considered as having the overwhelming influence on the control of insect life. Insects are killed in the stage where tolerance is least—this is usually in the early stage of existence. The eggs of a Schistocerca grasshopper, for example, present a high mortality while the young hoppers themselves are very tough. This showed the importance of careful life-history studies for the understanding of epidemics. A sigmoid curve showing first a slow increase, then a rapid increase, finally a uniform population density level—where nevertheless food might be in plenty, but fertility was lowered, demonstrated very well the proper point at which a pest showing this population curve would best be controlled.

A number of problems were considered:

(1) The relative fertility of a certain insect (e.g., a coccid) on different food plants.

(2) Host resistance—sometimes obvious, e.g., hairiness, hardness, smothering sap, oil cells.

(3) Biological resistance—Host must be suitable, else parasite perishes, e.g., host leucocytic action on parasite eggs. Much parasite mortality. Here it was pointed out that a hundred parasitized caterpillars, for example, represented not one hundred, but probably several hundred parasite eggs laid to effect this parasitism.

Parasites produce biological equilibrium.

Dr. Bodenheimer gave his impression of conditions in Hawaiian economic entomology—due largely to the lack of well-marked seasons, parasitic control was here especially good. He advised strongly that more and systematic study be given the part nutrition, climate, parasites and other factors play in insect control; in other words to make epidemiological analyses here.

By this method the effect and degree of parasitism here would be best understood.

Theoretical possibilities in relation to pests and parasites in Hawaii were stated:

(1) If the host and its parasite have the same climatic tolerance there will result a cumulative parasitism.

(2) If the parasite has the better climatic tolerance the parasitism will be better.

(3) Outbreaks are rare here, perhaps on account of the rare climatic oscillations—fluctuations of insect abundance would still be less.

(4) As regards the fruit fly, there is a possibility of the existence of an optimum center of parasitism.

Dr. Bodenheimer concluded with photographs of identical objects taken through the lens of a butterfly and of man; those taken through the human lens gave the better, more detailed image.

On behalf of the Society, President Mason thanked Dr. Bodenheimer for his very instructive talk.

AUGUST 6, 1931

The 307th regular meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., on August 6, 1931, at 2:30 p.m.

Members present: Messrs. Au, Bryan, Carter, Chapman, Chock, Hagan, Hong, Illingworth, Ito, Keck, Lau, Mason, McBride, McPhail, Mitchell, Pemberton, Smith, Stanley, Van Zwaluwenburg, Sakimura, Weinrich, Whitney and Williams.

Visitors: Messrs. H. P. Agee, L. O. Howard, Hoffman, Kamito, le Roux, Riley, Silva, Vaughan and Amy Suehiro.

President Mason called the meeting to order.

The minutes of the preceding regular meeting were read and approved, and reference was made to the special meeting of July 27, in honor of Dr. Bodenheimer.

The meeting was concerned mainly with the distinguished visitors present.

Dr. L. O. Howard spoke of the importance in publishing one's observations, even though they be fragmentary. From such, future

biological conclusions might be derived. The Entomological Society of Washington is also publishing such notes. He also gave entomological news items from Washington, D. C.

Dr. Wm. A. Hoffmann, who is stationed at Lingnan University in China and who is much interested in aquatic Hemiptera said that there are about fourteen biological journals in China, of which a large proportion were commenced during the last two years. The new species are described in readable language in such journals.

Dr. Wm. A. Riley of the University of Minnesota and now on his way to China made some observations on medical zoology and entomology.

Dr. A. Kamito, a government entomologist in Tokyo, Japan, exhibited some insect pests of rice in Japan and some of the parasites of such pests.

Mr. Pemberton exhibited a specimen of the small bethylid wasp, *Holepyris hawaiiensis,* several of which had recently stung persons in Honolulu, with rather unpleasant effects.

Some varied discussion followed.

SEPTEMBER 3, 1931

The 308th regular meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., at 2:30 p.m. on September 3, 1931.

Members present: Messrs. Bianchi, Bryan, Carter, Hagan, Hong, Illingworth, Keck, Mason, Marlowe, Mitchell, Pemberton, Rosa, Smith, Swezey, Van Zwaluwenburg and Williams.

Visitors: Thos. G. Eckart and Miss Amy Suehiro.

President Mason called the meeting to order.

Mr. Van Zwaluwenburg made reference to the outline of study of Insect Ecology that was given him by Dr. Bodenheimer and stated that it could be mimeographed for distribution among the entomologists here. Dr. Carter moved this be made a motion; it was seconded by Dr. Hagan and passed.

Mr. Bryan proposed the name of Prof. Olsen, teacher in Entomology at the University of Hawaii, for membership.

President Mason spoke of the dinner and informal meeting

of the Hawaiian Entomological Society held the evening of August 19, at the Blaisdell Hotel, in honor of Dr. L. O. Howard. Forty-eight persons were present—members and their wives and visitors, including Dr. L. O. Howard, Col. Chas. E. Davis and Dr. Akira Kamito. An enjoyable evening was had by all.

PAPERS

Mr. Pemberton gave a paper entitled **"Irritation Caused by the Sting of the Bethylid Wasp,** *Holepyris hawaiiensis* Ashm."

Mr. Van Zwaluwenburg, on behalf of Dr. E. Fleutiaux, presented two papers, one on descriptions of **New Melasid beetles,** and the other on **New Elaterid beetles.**

NOTES AND EXHIBITIONS

Mr. Swezey remarked on the meeting at Pasadena, in June, of the Pacific Slope Branch of the American Association of Economic Entomologists which he attended. About one hundred and seventy members were present. He spoke of the fine work done by the chalcid parasite *Coccophagus gucrneyi* on the citrophilus mealybug; of the earwig parasites, in Oregon; of the evolution of a soil sifter; of the importance of commercial work in entomology; of the bean thrips quarantine; and of the enjoyable collecting excursions, after the close of the meeting.

Dr. Carter mentioned burning on Kailua watermelon vines produced by the little jassid leafhopper Empoasca. Bordeaux mixture—regarded as an insect repellent—was taken up by this cucurbit an then sucked up by the leafhopper with deleterious results to the latter.

Kamehamcha Butterflies and Koa trees.—Mr. Bryan reported that Mr. E. L. Caum had related the experience of finding the large gray click beetle, *Chalcolepidius erythroloma* Candèze, on a koa branch, and around the white, semicrystalline, hardened sap, which had exuded from the injury it had made, a semicircle of seven Kamehameha butterflies, each with the tip of its proboscis between the head of the beetle and the hardened sap, apparently sipping the sap. This observation was made on July 18th, in the Land of Haukulu, upper Manoa Valley, on the Pauoa side of the valley.

Dr. Illingworth spoke of observing the clean-up by a fungus of the green coffee scale on Gardenia.

Polycaon stouti (Lec.).—Mr. Van Zwaluwenburg reported that a mutilated adult of this bostrichid beetle collected at Puunene, Maui, was received August 20 from Mr. F. W. Broadbent. It was found boring in a piece of furniture which had been imported from the Pacific Coast in November, 1929. The species is a native of Oregon, California and Arizona, attacking dead eucalyptus, etc., and occasionally living trees. It is sometimes a pest of cured hard woods. The only other specimen recorded from these Islands is one that issued from a table top in Honolulu in 1922.

Probable Type-Locality of Simodactylus tastui (Le Guill.).—Mr. Van Zwaluwenburg stated that Schenkling (1925, Junk's Coleopterorum Catalogus, part 80, p. 101) incorrectly gives the habitat of the Polynesian elaterid beetle *Simodactylus tastui* (Le Guillou) as Hawaii. The species is not known, or elsewhere recorded, from the Hawaiian Islands.

Candèze (1859, Mon. des Elat., II, p. 152) says of this species that Le Guillou "fait a connaitre . . . un insecte de Hamoa, l'une des isles de l'archipel des Amis . . . ". Friendly Islands was Capt. Cook's name for the Tonga group. Search of all available literature, including Dr. W. T. Brigham's Index to the Pacific Islands, fails to disclose any such island name in the Tonga, or any other, group of Pacific islands.

However, as pointed out by Mr. E. H. Bryan, Jr., and Dr. Peter Buck of the Bishop Museum, many South Pacific islands lack an "S" in their language, and in place of it use an "H". Savaii of the Samoa group, for example, is identical with the name Hawaii. It therefore seems probable that *Simodactylus tastui,* which is not an Hawaiian insect so far as known, is really a Samoan species.

A new immigrant Elaterid beetle.—Mr. Van Zwaluwenburg reported that on the evening of August 18, 1931, Mrs. R. H. Van Zwaluwenburg, in a house on Lanihuli Drive, Manoa, Honolulu, captured an Elaterid adult at light, which from its size (16.0 mm.) was at first mistaken for the common Simodactylus present here. Examination shows it to be a Monocrepidius, dis-

tinct, however, from *M. exsul* Sharp. It is very close to an unnamed specimen from Queensland in the H.S.P.A. collection, and it may be an Australian species. A second specimen (a male) was taken August 26 near Diamond Head, Oahu, by Mr. Pemberton.

A First Record of the Coleopterous Family Scydmaenidae in Hawaii.—Mr. Van Zwaluwenburg reported that two minute beetles taken by himself in August, 1930, in soil in the forest on Tantalus, Oahu, at about 1200 feet, have been determined by Mr. G. E. Bryant, of the British Museum, as *Cephennium* sp., "not in British Museum". This genus belongs to the family Scydmaenidae, a family apparently not recorded from the Territory heretofore. The genus Cephennium Müll. and Kunze, according to part 70, Colepterorum Catalogus, by E. Csiki, contains 94 species, mainly European and North African, with four species recorded from North America, two from Singapore and one from Ceylon. The species from Tantalus definitely is not the single species recorded from California, which is described as eyeless.

Systole geniculata Först.—The rearing of numerous specimens of this seed-chalcid from fennel seeds collected near the polo field on central Maui, July 6, 1931, by Mr. O. H. Lyman, was reported by Mr. Van Zwaluwenburg. Previously reported from Oahu and Hawaii, this is the first time this species has been obtained from Maui.

Macranillus atomus Jeannel.—Paratype specimens of this newly described minute Carabid received from Dr. G. A. K. Marshall were exhibited by Mr. Van Zwaluwenburg. These specimens were taken in cane-soil studies on Oahu, averaging 13 per square foot (to a depth of 9 inches) and being most numerous between 5 and 9 inches, in both growing-cane soil and fallow soil. Their minute larvae are fairly numerous in the lower soil depths.

The genus Macranillus was erected by Sharp (1903-Fauna Hawaiiensis, III, p. 287) based upon *M. coecus* Sharp, (a unique) from the high plateau on Kauai. Macranillus is separated from Nesomicrops by reason of having the eyes not pigmented or faceted, but represented by two small, smooth, slightly raised

Mr. Pemberton spoke of the present scarcity of *Omiodes blackburni,* the coconut leafroller on Oahu. A discussion of its parasites followed and *Cremastus hymeniae* was regarded as probably one of its checks.

President Mason said that two fruit fly parasites had just been sent from Hawaii to California as possible parasites on the walnut husk maggot.

Dr. Williams on behalf of Mr. Weinrich, who was unable to attend the meeting, presented a note on *Stapelia gigantea,* an African asclepiad plant with a large malodorous flower which attracted blowflies and induced them to deposit their young on it. Reference was also made to the papaya fruit fly, an American insect not found in Hawaii.

Holochlora japonica Brunn.—Dr. Williams reported this large green locustid as quite abundant on August 9, 1931, at the edge of Poamoho forest reserve at an altitude of about 1400 feet in the Koolau Mts., Oahu. Here also the Philippine wasp *Larra luzonensis* was seen on one of the trails, as well as a single worn specimen of the immigrant sphecid wasp *Isodontia harrisi* Fernald, first taken by Mr. Swezey and himself at Waianae.

OCTOBER 1, 1931

The 309th regular meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., at 2:30 p.m., October 1, 1931.

Members present: Messrs. Ehrhorn, Hagan, Illingworth, Ito, Keck, Marlowe, Mason, McBride, Olsen, Rosa, Sakimura, Smith, Van Zwaluwenburg and Weinrich.

Visitors: Messrs. G. H. Godfrey and W. J. Hartung.

President Mason called the meeting to order and appointed Mr. Van Zwaluwenburg as secretary pro tem.

Mr. O. Wilford Olsen was elected to active membership.

Mr. Ehrhorn gave an interesting account of his visit to the Pacific Coast. He stated that the California Termite Commission is completing an exhaustive report which will be published by the end of the year. He described the treatment of timbers with creosote against termites, and gave an account of his visits to various scientific centers in California.

Dr. Hagan inquired about the distribution of the native Hawaiian rat, being particularly interested in the parasites of this rat.

Dr. Illingworth reported the native rat, *Rattus hawaiiensis* Stone* to be at present very numerous on Oahu from the Waianae Mts. to Kahala, though until lately it was believed to be confined to Popoia Island in Kailua bay. Specimens from Oahu were determined by Dr. Miller of the U. S. National Museum as the native rat, and Dr. H. E. Ewing reported that the parasites present were the same as those occurring on *R. concolor* of Asia. Dr. Illingworth expressed the opinion that *concolor* is the ancestor of *hawaiiensis* and of the other species of Pacific rats.

Mr. W. J. Hartung read a reference by Dr. A. D. Voûte (Landbouw, December, 1931, p. 715) describing the elimination of Lecanium and other scales from citrus trees in Java, by the simple expedient of eliminating ants from the trees by the use of tanglefoot on the trunks. Mr. Hartung exhibited gardenia plants infested with *Coccus viridis* (Greene), one of which, untreated, was heavily infested, while the other, banded with tanglefoot, had numerous larvae and pupae of *Azya luteipes* Muls. which had nearly eradicated the scale in a single month's time. It was suggested that the tanglefoot treatment was well adapted to coffee trees in Kona, where the green scale is a serious pest.

President Mason introduced Mr. O. Wilford Olsen, who spoke of his work at the University, and of his interest in the histophysiology of *Thrips tabaci* Lind. with reference to investigation of the reason why this species can pick up virus of pineapple yellow spot in the nymphal, but not in the adult stage.

Mr. Ehrhorn exhibited an excellent photograph taken in San Francisco on July 29 of Dr. L. O. Howard, Mr. Brosius, plant quarantine inspector at San Francisco, and himself.

NOVEMBER 5, 1931

The 310th regular meeting of the Hawaiian Entomological Society was held November 5, at 2:30 p.m., at the H.S.P.A. Experiment Station, Honolulu.

* See Occ. Papers, B. P. Bishop Museum, Vol. 3, no. 4, 1917.

Members present: Messrs. Au, Bianchi, Bryan, Ehrhorn, Fullaway, Hagan, Keck, Mason, Olsen, Pemberton, Rosa, Smith, Swezey, Van Zwaluwenburg, Wilder and Williams.

Visitors: Miss Amy Suehiro, Messrs. Krauss and Phillips.

President Mason called the meeting to order.

The minutes of the preceding meeting were read and approved.

President Mason enquired re the work of the committee on procuring photographs of entomologists. Mr. Ehrhorn presented the society with photographs, chiefly of Dr. L. O. Howard.

Mr. Fullaway made a motion of appreciation of Mr. Ehrhorn's donation of the pictures. Seconded by Mr. Wilder and passed.

On President Mason's suggestion, it was decided to have a picture taken of the Entomological Society, at the annual (December) meeting.

"Micropezidae From the Indo-Pacific Region."

BY E. H. BRYAN, JR.

"Insect Exploration in the Hilo Forest Reserve at the 5000 ft. Level."

BY O. H. SWEZEY AND F. X. WILLIAMS.

"Insects From the Summit of Mauna Kea."

BY O. H. SWEZEY AND F. X. WILLIAMS.

Mr. Van Zwaluwenburg presented the title of a paper by Dr. J. W. Folsom, on **"Hawaiian Collembola."**

NOTES AND EXHIBITS

Sciomyza hawaiiensis Grimshaw.—Mr. Bryan exhibited specimens of this fly. He stated that it had remained unknown in collections until Dr. Aldrich recently determined specimens, which had been among some undetermined species. It is now known from many parts of Oahu, as well as from Puna, Hawaii; Kapaa, Kauai; and Kailua and Keanae, Maui. It is locally abundant, and probably of general distribution on the larger islands of the group.*

* *Chiromyia (Scyphella) flava* (Linn.). See Proc. Haw. Ent. Soc. VI, p. 228, 1926.

Coccotrypes dactyliperda (Fab.).—Mr. Swezey reported having collected this scolytid under date palm trees in the grounds of Lihue Hotel on Kauai, March 11, 1928, which is the first record of its occurrence on that island.

Coccotrypes pygmaeus (Eich.).—Mr. Swezey also reported collecting this beetle at the same place on Kauai as *C. dactyliperda,* which would be its first record for Kauai.

Diorymerellus laevimargo Champ.—Mr. Swezey called to attention that this orchid weevil has escaped being recorded in the Proceedings of the Hawaiian Entomological Society, except for the time when it was first exhibited as an unknown weevil, captured by Dr. Lyon on an orchid. See Proc. Haw. Ent. Soc. III, p. 83, 1915. The beetle was first found on an orchid (Dendrobium) by Dr. H. L. Lyon, July 20, 1914; again October 5, 1914; and again February 2, 1915.

Sitophilus rugicollis (Casey).—Mr. Swezey exhibited two specimens of this calandrid beetle, one taken September 19, 1931, at the Vineyard Street Nursery, and the other at the grounds of the Experiment Station, H.S.P.A., October 12, 1931. The only previous record of this weevil in Hawaii is a specimen caught in house in 1928, recorded in Proc. Haw. Ent. Soc. VII, No. 2, p. 279, 1929. The finding of the latest specimens indicates that it must be established here. It remains to be learned what seed it lives in. In India it is known to attack the seeds of *Shorea robusta* and *Dipterocarpus turbinatus.*

Volucella pusilla Macq.—Mr. Swezey reported that Mr. W. J. MacNeil had handed him four specimens of this syrphid fly that had been reared from maggots found in rotten cactus stem. It is the first record of its breeding habits. The first specimen of this recent immigrant was taken in Oahu Sugar Co. plantation, October 30, 1930. It was later found quite common at Red Hill and in Manoa Valley.

Epilachna boisduvali Muls.—Miss Suehiro presented a note and exhibit of an Epilachna from Samoa. Among the insects collected in Samoa by D. T. Fullaway, and presented to the Bishop Museum, is a Coccinellid which closely resembles *Epilachna*

boisduvali Muls. This is a new record for Samoa. *E. boisduvali* has been previously recorded from Fiji and New Caledonia.

Culex nigriceps Edwards in Tahiti.—Mr. Bryan exhibited specimens of this mosquito from Tahiti, which had been sent to him by Dr. P. H. Buxton, of the London School of Hygiene and Tropical Medicine. In the Bulletin de la Société des Études Océaniennes, No. 21, for October, 1927, Dr. Buxton states that this species is found only in Tahiti. He speaks of it as a dark species, with white spots over the eyes, but without any other markings on the body or legs.

Other mosquitoes recorded from the Society Islands are:

Culex fatigans Wied.
Culex annulirostris (Skuse).
Aedes aegypti (Linn.).
Aedes variegatus Doleschall.

Dr. Williams spoke of, and exhibited some insects taken at Nauhi, Hawaii, 5200 ft. and over, during September and October of this year. They included the vegetable weevil, a species of Scatella breeding in a water pocket in a tree at 5800 ft. Also a *Brachydeutera* breeding in a gallon of water in an iron pot at Keanakolu, 5250 ft. He exhibited larvae of a staphylinid beetle parasitized by a proctotrypid wasp.

At this altitude, no termites nor ants could be found, though Culex mosquitoes were present. No Scolopendra centipedes, no Heteropoda spiders. Bats were fairly common and were on the wing shortly after 4:00 p.m. Native hawks were present in the mamani (Sophora) zone.

Mr. Fullaway gave an account of his trip to the Orient in quest of thrips parasites and of the difficulty of rearing these tiny parasitic wasps. He said that in the Orient he observed that the taro leafhopper (*Megamelus proserpina* Kirk.) was well controlled by parasites.

Mr. Mason spoke of an outbreak of armyworms near Woodlawn, Honolulu. Two or three acres of grass had been eaten. The caterpillars were on the march. It was remarked by Fullaway that armyworms were also common in the Hind-Clarke dairy region, and by Pemberton, at Waimanalo.

Copris incertus var. *prociduus* (Say).—Mr. Ehrhorn said that Dr. Wilder and himself had found the Mexican dung beetle common at Kula, Maui.

DECEMBER 3, 1931

The 311th regular meeting of the Hawaiian Entomological Society was held at the Experiment Station of the Hawaiian Sugar Planters' Association on December 3, 1931, at 2:30 p.m.

Members present: Messrs. Bianchi, Bryan, Carter, Ehrhorn, Fullaway, Hagan, Hong, Illingworth, Ito, Keck, Lau, Marlowe, Mason, McBryde, Olsen, Pemberton, Rosa, Sakimura, Smith, Swezey, Van Zwaluwenburg, Wilder and Williams.

Visitor: N. H. Krauss.

President Mason called the meeting to order.

The minutes of the previous meeting were read and approved.

The Secretary read the minutes of a meeting of the executive committee and the correspondence thereof, held at the instance of the Chairman of the Pacific Entomological Survey for the purpose of expressing its views relative to the continuation of the work of the Pacific Entomological Survey.

It was moved by Dr. Carter, seconded by Dr. Wilder and passed by the Society, that this act of the Executive Committee be approved.

In this connection Messrs. Swezey and Bryan exhibited two preliminary reports of the Pacific Entomological Survey. These reports were excellent.

The secretary-treasurer reported on the finances of the Society for 1931.

The receipts were $653.95, the expenditures $520.63 and the cash on hand December 3, 1931, $133.32.

Officers elected for 1932:

President—Dr. R. N. Chapman.
Vice-President—Dr. Harold Hagan.
Secretary-Treasurer—Dr. F. X. Williams.
Executive Committee—O. C. McBryde and E. M. Ehrhorn.

After a short business speech by President Mason, the members of the Society went out of doors, in a suitable place, and had a photo taken.

PAPERS

The President delivered his annual address.

"The Economic Importance of the Mediterranean Fruit Fly to Hawaiian Horticulture."

"Some Effects of Pseudococcus Brevipes (Ckl.) **on Pineapple Fruits."**

BY DR. WALTER CARTER AND K. ITO.

"Notes on Insects Found on Pineapple Planting Material."

BY K. ITO AND DR. WALTER CARTER.

"A Leafhopper Burn of Cucurbits on Oahu, T. H."*

BY DR. WALTER CARTER.

Mr. O. H. Swezey presented a paper by title:

"Descriptions of New Encyrtidae and Scelionidae from the Philippines and Malay States."

BY P. H. TIMBERLAKE.

"New Species of Hawaiian Lepidoptera."

BY O. H. SWEZEY.

NOTES AND EXHIBITION OF MATERIAL

Celphalonomia tarsalis (Ashm.).—Mr. Swezey reported that he had recently received from Mr. Gahan this determination of a bethylid that has on several occasions been reared from cocoons found in raisins infested with *Oryzaephilus surinamensis* (L.). This bethylid is nearly a cosmopolitan species, and it is the first time it is recorded in Honolulu. Mr. Swezey's dates of collection in Honolulu are: January 4 and 10, 1916; October 24, 1925; September 3, 1926; and February 15, 1930. It is the *Cephalonomia* sp. mentioned in Proc. Haw. Ent. Soc., III, p. 260, 1917.

Acerophagus notativentris (Gir.).—Mr. Swezey reported that Mr. Timberlake had identified as this encyrtid, a specimen which had issued October 30 from the parasitized mealybugs in a bunch of grapes from California. Three more parasites had issued, but

*Not available for publication [Ed.]

were lost. The mealybug was not identified, but might have been *Pseudococcus maritimus* (Ehrhorn).

Cardiocondyla wroughtonii var. *hawaiiensis* Forel.—Mr. Swezey called to attention that in a paper in Psyche, Vol. 38, p. 83, 1931, Dr. Wheeler mentions a gynandromorph ant of this species, which is in the collection at the Experiment Station, H.S.P.A. It is the same specimen recorded in Proc. Haw. Ent. Soc., VI, p. 229, 1926, as "apparently *Cardiocondyla nuda minutior* Forel." Dr. Wheeler also mentions that in the same collection he found another gynandromorph ant of the same species.

Philippine Anagyrus.—Dr. F. X. Williams reported the recovery of the Philippine Anagyrus wasp, parasitic in our pink sugar cane mealybug, at Koloa Sugar Company on November 20, 1931, and Grove Farm Company, Ltd., and Lihue Plantation, Ltd., on November 13, 1931, all on the island of Kauai. This parasite was received from F. C. Hadden at Los Banos, Luzon.

Aeschrithmysus n. sp. (?).—Dr. Williams exhibited a longicorn beetle (Aeschrithmysus ?), probably a new species. A single female was reared from the stem of *Vaccinium pelcanum* Skotts., procured October 3, 1931, above Nauhi, Hawaii, at an elevation of about 8500 feet, issued on November 27, 1931.

Athesapeuta cyperi Marshall.—Mr. Pemberton spoke of having found the nutgrass weevil established at Waianae, Oahu.

*Mutillid on Oahu**.—Professor Olsen mentioned that a female mutillid wasp had recently been taken on Oahu by one of his students.

Volucella pusilla Macq.—Mr. Fullaway reported that he collected this syrphid fly at Waianae, Oahu.

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* It was later ascertained that the specimen had probably been obtained from the mainland. [Ed.]

Micropezidae (Diptera) From the Indo-Pacific Region

BY E. H. BRYAN, JR.

(Presented at the meeting of November 5, 1931)

The following species of Micropezidae in the collections of B. P. Bishop Museum have been determined by E. T. Cresson, Jr., of the Academy of Natural Sciences, Philadelphia.

Tanipoda caligata Rondani.
Manorg, W. Borneo, (Muir).

Tanipoda cubitalis Rondani.
Noesa, Kambangan, Java, December, 1908, (Terry).

Calobata albitarsis Wiedemann.
Pontianak, Borneo, (Muir); Pekalongan, Java, April, 1907, (Muir).

Calobata galbula Osten Sacken.
Los Banos, P. I., August, 1916, (Williams); Singapore, March, 1907, (Muir); Guam, (Fullaway).

Taniaptera albimana Dol.
Amboina, July, 1908, (Muir).

Telostylus latibrachium End.
Buitenzorg, Java, (Muir).

Nerius (Telostylinus) lineolatus Wiedemann.
Rewa, Fiji, 1929, (Pemberton); Nausori, Fiji, 1913, (Illingworth); Guadalcanar, Solomon Is., 1921, (Kusche); Pontianak, Borneo, (Muir); Amboina, 1908-9, (Muir); Makassar, Celebes, January 8, 1909, (Terry), April, 1908, (Muir); Cairns, N. Queensland, 1918, (Illingworth).

Nerius (Rhoptrum) annulipes Dol.
Amboina, 1907-8, (Muir).

Nerius (Rhoptrum) mantoides Walker.
Laloki, Papua, 1910, (Muir).

Nerius (Gymnonerius) fuscus Wiedemann.
Java, 1907, (Muir).

Proc. Haw. Ent. Soc., VIII, No. 1, Nov., 1932.

Gymnonerius dimidiatus Oresson.

Los Banos, P. I., 1916, (Williams). (Type and Allotype).

Eurybata hexapla Osten Sacken.

Los Banos, P. I., 1917, (Williams).

Eurybata semilauta Osten Sacken.

Amboina, (Muir).

Eurybata nigriventris End.

Manorg, W. Borneo, (Muir).

Nestima polita Osten Sacken.

Laloki, Papua, 1910, (Muir).

Mimomyrmecia tessellata Frey.

Los Banos, P. I., 1916, (Williams); Manila, P. I., January, 1908, (Thompson).

A New Species of Proisotoma (Order Collembola) from India

BY JAMES MEIKLE BROWN, B.SC., F.L.S., F.E.S., SHEFFIELD, ENGLAND

(Presented by Dr. F. X. Williams at the Meeting of April 2, 1931)

Three specimens of a species of Collembola were forwarded by Dr. F. X. Williams of the Experimental Station of the Hawaiian Sugar Planters' Association for determination, and as they do not appear to conform in structure to any recognized species, a description is appended. The specimens were intercepted in quarantine at Molokai, Hawaiian Islands, from "seed pieces" of sugar cane packed in moist charcoal in metal containers that were received from Coimbatore, India, in early December, 1930.

I have to thank Dr. Imms of Rothamsted for the opportunity of examining and describing the specimens.

Proisotoma (Isotomina) indica sp. n.

Colour greyish-white, with very little bluish-black pigment in the form of small round spots at the front and sides of the head, and as faint patches dorsally on the posterior segments. Eye patch only partially pigmented, densely so in front, more sparsely so elsewhere. Fig. 1.

Hairs short and uniformly scattered, very slightly curved and almost adpressed. The posterior segments with a few slightly longer ones. All the hairs simple.

Antennae slightly longer than the head, as 11 : 9. Antennal segments approximately as 11 : 6 : 7 : 5. Segment I without specialized olfactory hairs. Antennal organ II typical.

Eyes five on each side, the anterior ones obscured by the pigment of the eye-patch.

Mandibles with four apical teeth, and strong masticatory ridges.

Postantennal organ oval, slightly contracted at about the middle, with thickened margins, and a projecting curved ridge reaching from the middle of the posterior margin across the centre of the organ to near the anterior border, and tapering to a point. Figs. 1 and 2.

Legs without tenent hairs. Claw with one very small tooth slightly beyond the middle. Empodial appendage narrow and pointed, reaching to the tooth of the claw, the outer lamella narrow, the inner lamella wider but without a strongly rounded inner angle. Fig. 3.

Fork not reaching to the ventral tube. Dentes about twice the length of the manubrium. Manubrium with two strong ventral bristles on each side of the apex, dorsally with a few scattered hairs. Dentes ringed dor-

sally except at the extreme base and apex, with several dorso-lateral hairs. Ventrally with the usual arrangement of adpressed hairs, about nine in number, the last not reaching beyond the middle of the mucro. Mucrones with two almost equal teeth. Fig. 4.

Tenaculum with four barbs on the rami and a strong curved bristle on the corpus. Fig. 5.

Abdominal segment IV slightly longer than segment III, as 6 : 5. Segments V and VI combined and together about equal to segment III.

Size from .8 to .9 mm.

Proiostoma (Isotomina) indica

FIG. 1. Side of head, showing postantennal organ and pigmentation of eye-patch.
FIG. 2. Post-antennal organ.
FIG. 3. Apex of leg.
FIG. 4. Apex of spring, showing mucro.
FIG. 5. Tenaculum.

Locality: Three specimens, on cane cuttings, Coimbatore, India.

The type slide will be deposited in the British Museum (South Kensington).

This species bears a strong likeness to *Proisotoma* (*Isotomina*) *thermophila* (Axels.), a species which is found occasionally in hothouses in Europe; but differs from it essentially in the number of eyes, the structure of the post-antennal organ, the number of bristles at the apex of the manubrium, and in other minor details.

Some Effects of *Pseudococcus brevipes* (Ckl.) on Pineapple Fruit *

BY DR. WALTER CARTER AND K. ITO

(Presented at the meeting of December 3, 1931)

During the harvest season of 1931 considerable spoilage of pineapple fruit was reported, caused by cracking of the basal eyes with a resultant leaking of juice from the fruit. The leaking fruits were invariably infested with souring beetles and at the bases of the fruit evidence was clear that high mealybug populations either were, or had been present. In our experimental plot, which had been used for spray experiments for some time previously, it was possible to compare fruits that had been kept clean of mealybugs with those on which high populations had developed. On examination of these plots it was clearly suggested that mealybug infestation bore a close relationship to cracked and leaky fruits. In order to obtain more exact data on this subject a section of the field, California Packing Corporation Field 71, Kunia, Oahu, where a critical study of mealybug population growth and progress into the fields has been made, was selected as a source for obtaining fruit both uninfested and heavily infested with mealybugs.

The section consisted of two sprayed blocks, A and C, on either side of a check or unsprayed block, B. Only the outer eight beds on one end of the sprayed blocks were sprayed with an oil emulsion to keep out the gradual influx of mealybugs from the adjacent wild vegetation. Successive samples of plants taken within these blocks showed that the central portions of the two sprayed blocks were relatively free of mealybugs, or at least with a very light infestation. On the other hand, the outer beds of the check block were very heavily infested with mealybugs.

Here, as elsewhere, it was observed that mealybugs have a tendency to congregate on the more tender portions of the pineapple plant. Prior to the development of the inflorescence, the

* Published with the approval of the Director as Technical Paper No. 45 of the Experiment Station of the Association of Hawaiian Pineapple Canners, University of Hawaii.

mealybugs infest the central tender leaves, but when the fruit is formed, they move up to the fruit and thence to the crown. They propagate to an enormous population on the crown and maturing fruit, especially on the butt end of the fruit where they are more or less sheltered and protected from the numerous predators.

Analysis of the last sample taken on July 2-7, 1931, indicated that beds 36 to 45 of Block A and beds 26 to 40 of Block C had only a very light infestation of mealybugs, whereas beds 1 to 15 of Block B had a very heavy infestation. To facilitate sampling, each of the three blocks was subdivided into small plots of five 60-foot beds, thus forming five plots throughout the width of the 300-foot block. Crown samples were taken at every tenth plant interval, alternately from the first, second and third lines of every odd 3-line bed of each plot of the three blocks. Thus, 12 crown samples were taken from each 300-foot bed.

Out of the 120 samples, taken from the above designated 10 beds of Block A, only one crown had a single mealybug, and of the 180 samples from that of the 15 beds of Block C, 28 were infested with an average of 47 mealybugs per crown infested. Contrastingly, out of the 180 samples taken from the first 15 beds of check Block B, all crowns had a heavy infestation with an average of 190 mealybugs per crown infested. (See Table 1).

The assumption was made that the degree of mealybug infestation on the crowns was indicative of the infestation on the fruits. Subsequently, all ripe fruits were picked from within the designated portions of each of the three blocks on July 23, 1931, when the fruits became mature. They were packed into regular pineapple crates which were marked and segregated according to the respective blocks. These crates of fruits were then brought into the laboratory for inspection.

In the laboratory, each fruit was examined for any superficial manifestations of cracked and leaky spots among the "eyes" of the fruits. The fruits were thereby classified as normal, those showing no cracked or leaky spots; cracked, those with corked-over cracks only; and leaky, those from which the juice was exuding from cracks in the corky tissues. The following record shows the results of the examination:

TABLE 1

Mealybug population from crowns with associated data on fruit quality:

Block No.	No. of Crowns in Sample	Percentage of Crowns Infested	Average Population of Mealybugs per Infested Crown	Normal Fruits	Cracked Fruits	Leaky Fruits	Total No. of Fruits Examined
A	120	0.8	1	232	18	0	250
B	180	100	190	92	176	36	304
C	180	15.5	47	299	29	4	332

Although no quantitative data were obtainable on the subject, it was also indicated that the establishment of heavy mealybug populations on the base of fruit so weakened the tissue between the "eyes" that entrance of the souring beetles was very much facilitated. It is also true that a leaky fruit rapidly becomes a fermenting fruit, so that the indirect effect of mealybugs in encouraging souring beetle infestation must also be reckoned with.

CONCLUSION

The results clearly indicate that the presence of mealybugs in large populations at the base of fruits considerably reduces the quality of fruit by rendering the basal slices unmarketable as well as increasing the number of culls due to leaking and fermentation. No laboratory experiments have been undertaken, but the clear correlation in the field data seems to be conclusive on these points.

Notes on Insects Found on Pineapple Planting Material*

BY K. ITO AND DR. WALTER CARTER

(Presented at the meeting of December 3, 1931)

In the study of insects and their relation to pineapple production, investigations have shown that injurious insects, such as mealybugs and scales, which are closely attached to the host plant upon which they feed and propagate, can be disseminated over a wide area by the use of planting materials infested with them.

At the present time it would appear that the difficulties of mechanical handling precludes the treatment of planting material prior to planting in the usual fall planting season. Experience has shown, as a matter of fact, that the great majority of the insect populations on this planting material disappear due to natural causes within a few months after planting, even though the percentage that remains infested still presents an important problem. The planting material to be used for replanting, however, is stored on trimming grounds during winter in closely packed masses. Frequently this material can be seen heavily infested with *Diaspis bromcliac* (Kern.), the pineapple scale. when it is planted in the spring. It was thought that possibly some simple method of treating this planting material could be devised which would insure cleaner planting material being used for replants. The importance of using clean planting material for replants is very great since at the time it is planted the surrounding plants are growing in a very succulent condition, so that there is a tendency for the insects on the dry freshly planted replants to move on to the adjoining older plants. The result is that considerable spread of insects may occur.

In December, 1930, an experiment to determine the effect of high temperature in checking insect infestation on pineapple planting material, while in the process of curing on the trimming grounds, was initiated at two separate localities in the Helemano section of the Hawaiian Pineapple Company's fields. The

* Published with the approval of the Director as Technical Paper No. 48 of the Experiment Station of the Association of Hawaiian Pineapple Canners, University of Hawaii.

primary purpose of this investigation was to collect quantitative data on insect fauna present and to determine the effect of atmospheric heat on the pineapple scale infesting planting material.

In carrying out the experiment, part of the planting material on the trimming ground was enclosed, butt ends up, under a large celoglass-covered enclosure where the temperature was thought to become sufficiently increased to clean the planting material of insect infestation. Another part of the material was left out in the open, with the butts of the plants turned upward, as in ordinary practices of curing.

Temperature records were kept of three different conditions at the two places as follows: (1) Thermograph under standard shade; (2) with the thermo-element placed at a horizontal position about two inches above the ground in the middle of the check materials; (3) with the thermo-element placed at a horizontal position about two inches above the ground in the middle of the material under the celoglass-covered enclosure.

Final analysis of the different thermograph records at the two places showed no marked significance so far as the anticipated effects of temperature were concerned. The various insects seemed to persist under both celoglass and check conditions. Although the temperature rose as high as 99°F. when a mercury thermometer was exposed to the air on the butts of the plants under the celoglass, the temperatures obtaining within the mass of material showed only slightly higher temperature fluctuations than under the check, due to the insulation that the closely appressed planting material provided to the penetration of heat to the lower portions of the plant on which the insects were invariably found.

Comparison of the corresponding records of the two places manifested no greater variations than those encountered in the different sets of the one place. Consequently, all the following data on insect populations have been combined and considered as having existed under the same conditions of environment. Table 1 shows the weekly average maximum and minimum temperatures for the duration of the experiment.

TABLE 1. HELEMANO STATION STANDARD SHADE HYGRO-THERMOGRAPH RECORD

	Temperature		Humidity	
Week ending	Av. of daily maxima	Av. of daily minima	Av. of daily maxima	Av. of daily minima
12/21/30	74.5	67.1	89.0	57.0
12/28/30	75.1	62.7	90.0	53.0
1/ 4/31	74.9	62.4	84.5	50.1
1/11/31	75.8	65.6	89.0	55.3
1/18/31	75.0	61.3	89.9	52.1
*1/25/31	75.5	55.2	91.2	45.7
2/ 1/31	74.1	59.8	90.9	51.9
2/ 8/31	73.6	61.9	89.6	50.1
2/15/31	71.3	63.3	91.5	61.4
2/22/31	75.3	64.6	90.7	50.7
3/ 1/31	73.5	62.0	91.7	57.3
3/ 8/31	73.9	60.6	89.4	49.6
3/15/31	76.2	59.9	91.1	50.8

Records of the different species of insects encountered during the dissection of the planting material samples for the counting of the scales on the leaves are shown in Table 2. The first random sample of 55 plants was examined on December 17-19, 1930, at the beginning of the experiment and illustrates the kinds and degrees of initial populations. The data from the second sample were obtained by examining 120 plants at the conclusion of the experiment on March 25, 1931, and represent the populations that had accumulated during the winter. To simplify comparison, the data presented in the tables are a revision of the original data from the two unequal samples calculated on the basis of 100 plants per sample.

* Average of three days only. Recorder had stopped.

TABLE 2. INSECT SPECIES FOUND ON PINEAPPLE PLANTING MATERIAL STORED ON TRIMMING GROUNDS

Insect Species	No. of Individuals 1st Sample Dec. 1930	2nd Sample Mar. 1931
Araneida (Spiders)*	36	7
Acarina (Mites)	36	3
Collembola (Springtails)	38	67
Orthoptera:		
Blattidae (*Cutilia soror* Brunner)	....	1
Dermaptera (*Euborellia annulipes* Lucas)*	....	3
Corrodentia (*Ectopsocus fullawayi* Endl. and *E. hawaiiensis* Endl.)	104	27
Thysanoptera:		
Phloeothripidae (*Dolerothrips carteri* Watson)	129	51
Homoptera:		
Coccidae (*Pseudococcus brevipes* Ckll.)	293	11
(*Diaspis bromeliae* Kerner)	5851	583
Hemiptera:		
Reduviidae (*Empicoria rubromaculata* Blkb.)*	....	7
Coleoptera:		
Coccinellidae (*Sticholotis punctatus* Crotch)*	....	2
Nitidulidae (*Carpophilus humeralis* Fabr.)	....	1
Cucujidae (*Cryptamorpha desjardinsi* Guer.)*	....	20
Diptera:		
Chironomidae (Midge larvae)	63	8
Lepidoptera:		
Tineidae (*Ereunetis flavistriata* Walsm.)	80	5
Hymenoptera:		
Formicidae (*Pheidole megacephala* Fabr.)	13	1

CONCLUSION

It appears clear from the data that pineapple scale can maintain itself on dried planting material on the trimming ground. The same is true of the pineapple mealybug, *Pseudococcus brevipes* (Ckl.), in a lesser degree. At the beginning of the experiment the initial populations consisted mainly of phytophagus insects. The sample at the close of the experiment showed the persistence of these species with considerable reduction in numbers and the introduction of a number of predacious forms. It would appear then that careful selection of planting material to be used as replants would constitute the best control, since the reproduction of any phytophagus forms which may be on the plant would be severely limited by the accumulation of predators.

* Predacious forms.

Descriptions de trois Melasides nouveaux provenant des collections de la "Experiment Station of the Hawaiian Sugar Planters' Association"

PAR E. FLEUTIAUX

(Presented by R. H. Van Zwaluwenburg at the meeting of Sept. 3, 1931)

Fornax striatus nov. sp.

Long. 5m/m ½—Allongé, atténué, convexe; ferrugineux, élytres noirs; pubescence jaune sur la tête et le pronotum, obscure sur les élytres. Tête convexe, densément ponctuée; épistome déprimé, aussi large à la base que la crête surantennaire; carène interoculaire interrompue au milieu. Antennes longues, dépassant la moitié du corps, épaisses, filiformes jusqu'à la moitié, comprimées et élargies à partir du 7e article; noires, premier article ferrugineux; 2e article très court, beaucoup moins long que le 4e; 3e plus long que le suivant. Pronotum aussi long que large, légèrement rétréci en avant, très convexe très densément et rugueusement ponctué. Elytres convexes, atténués, obliquement tronqués au sommet, terminés par une courte épine; rugueux, moins fortement vers le bout, fortement striés, moins profondément en arrière. Dessous ferrugineux, métasternum et hanches postérieures noirâtres; fortement ponctué. Episternes métathoraciques nuls en avant, élargis en arrière. Hanches postérieures peu dilatées en dedans, plus larges en dehors que le bord inférieur des épisternes; abdomen comprimé sur les bords; dernier arceau ventral atténué. Pattes testacées; griffes dentées.

Nouvelle-Guinée: Koitaki, 1500 ft., novembre—décembre 1928 (Pemberton).

Espèce remarquable par sa forme convexe; sa surface rugueuse; ses antennes longues et élargies à partir du 7e article; ses épisternes élargis en arrière, nuls en avant; ses hanches postérieures plus larges en dehors que les épisternes. Se place dans le voisinage de *F. umbilicatus* Fleutiaux, de Bornéo.

Fornax (Ceratus) haddeni nov. sp.

Long. 8 m/m—Oblong, elliptique, épais; brun foncé; pubescence jaune. Tête convexe, densément ponctuée; épistome aussi large à la base que la crête surantennaire; carène interoculaire interrompue au milieu. Antennes filiformes, ne dépassant pas la base du prothorax, ferrugineuses; 3e article un peu plus long que le 2e et de même forme, notablement moins long que le 4e. Pronotum à peu près aussi long que large à la base, arrondi et graduellement rétréci en avant, convexe, densément ponctué. Elytres graduellement rétrécis en arrière, finement pointillés, substriés. Dessous de même couleur, finement pointillé. Hanches postérieures très larges en

dedans, anguleuses en arrière. Dernier arceau ventral légèrement échancré ou tronqué au sommet. Pattes ferrugineuses.

Iles Philippines: Mont Makiling, Laguna, 400 ft., avril 1931 (F. C. Hadden).

Ressemble beaucoup à *C. crassus* Fleutiaux, mais plus allongé.

Arhipis striata nov. sp.

Long. 8 m/m—Oblong, parallèle, brun rougeâtre; pubescence réduite à quelques poils jaunes sur les flancs des élytres. Tête aplatie en avant; ponctuation ombiliquée, rugueuse; épistome court, très rétréci à la base où il est plus large que la crête surantennaire; bord antérieur sinué, prolongé latéralement. Antennes ferrugineuses, courtes; 3e article à peu près aussi long que les trois suivants réunis. Pronotum à peine plus long que large, parallèle, arrondi aux angles antérieurs, déprimé sur le dos, légèrement sillonné en avant au milieu, et marqué d'une ligne lisse médiane en arrière; ponctuation ombiliquée serrée. Elytres rugueux et striés. Dessous un peu plus clair. Pattes ferrugineuses.

Iles Philippines: Mont Makiling, Laguna, avril 1931 (F. C. Hadden).

Cette espèce est facile à distinguer de *A. orientalis* Fleutiaux par sa forme plus courte, par ses élytres rugueux et plus fortement striés, et par la carène du bord antérieur du pronotum dirigée un peu au-dessus de la carène postérieure, comme dans le genre Farsus; mais cependant moins brusquement recourbée en arrière.

Descriptions d'Elaterides nouveaux des Iles Philippines, provenant des collections de la "Experiment Station of the Hawaiian Sugar Planters' Association"

PAR E. FLEUTIAUX.

(Presented by R. H. Van Zwaluwenburg at the meeting of Sept. 3, 1931)

Anchastus philippinensis nov. sp.

Long. 8 m/m ½—Allongé, elliptique, convexe; testacé brillant; pubescence jaune. Tête régulièrement convexe, ponctuée; bord antérieur arrondi. Antennes testacées, ne dépassant pas la base du prothorax; 3e article plus long que le 4e. Pronotum aussi long que large, arrondi latéralement et rétréci en avant, convexe; ponctuation peu serrée; angles postérieurs fortement et obliquement carénés. Elytres arrondis et atténués, finement pointillés, légèrement striés-ponctués; interstries plans. Dessous et pattes plus pâles.

Iles Philippines: Mont Makiling, Laguna, avril 1931 (F. C. Hadden).

Plus grand et plus étroit que *A. nitidus* Candèze; ponctuation du pronotum plus forte et plus dense; stries des élytres moins marquées; 3e article des antennes plus long que le 4e.

Megapenthes frontalis nov. sp.

Long. 6 m/m.—Allongé, peu convexe; pubescence jaune très légère. Tête noire, jaunâtre en avant, déprimée, carénée au milieu; bord antérieur arrondi et rebordé; ponctuation ombiliquée et rugueuse. Antennes dépassant la base du prothorax, serriformes, avec les 2e et 3e articles courts, globuleux; noires, les trois premiers articles jaunes. Pronotum noir, jaune à la base, plus long que large, graduellement rétréci en avant, peu convexe, ponctuation ombiliquée, serrée; angles postérieures grands, aigus, dirigés en arrière, bicarénés, la carène externe longue. Ecusson noir, triangulaire, fortement ponctué. Elytres noirs, jaunes à la base, entiers au sommet, rugueux, fortement striés-ponctués. Dessous jaune. Pattes plus claires.

Iles Philippines: Mont Makiling, Laguna, avril 1931 (F. C. Hadden).

Voisin de *M. inconditus* Candèze, mais de taille beaucoup plus petite; ponctuation plus forte, plus serrée et rugueuse. Se rapproche également de *M. curtus* Candèze; plus étroit, aspect moins brillant; plus noir, avec des taches jaune pâle; pronotum moins arrondi latéralement et graduellement rétréci; ponctuation plus

serrée; élytres plus rugueux et plus fortement ponctués-striés.

Megapenthes philippinensis nov. sp.

Long. 9 à 11 m/m ½—Oblong, atténué en arrière, convexe; brun clair brillant, parfois plus ou moins noirâtre sur le pronotum; pubescence jaune. Tête convexe, densément ponctuée; bord antérieur arrondi et rebordé. Antennes brun clair, fines, courtes; 3e article insensiblement plus court que le 4e. Pronotum à peu près aussi long que large, sinué sur les côtés, rétréci seulement aux angles antérieurs, convexe; ponctuation fine et peu serrée; angles postérieurs divergents, aigus, bicarénés. Elytres de la largeur du pronotum, graduellement atténués, finement pointillés, légèrement ponctués-striés. Dessous de même couleur, parfois noirâtre. Hanches postérieures peu élargies en dedans, anguleuses en arrière. Pattes jaunes.

Iles Philippines: Mont Makiling, Laguna, avril 1931 (F. C. Hadden).

Voisin de *M. inconditus* Candèze, forme plus atténuée; couleur plus claire; front non caréné; ponctuation beaucoup plus légère; antennes moins longues et plus fines; hanches postérieures moins élargies en dedans.

Megapenthes angustus nov. sp.

Long. 7 à 9 m/m—Allongé, filiforme; brun noirâtre, base des élytres parfois jaune; pubescence jaune. Tête convexe et densément pounctuée, arrondie en avant. Antennes fines, ne dépassant pas la base du prothorax; noires, premiers articles ferrugineux; 3e plus long que le 2e et moins que le 4e. Pronotum beaucoup plus long que large, parallèle, ponctué comme la tête; angles postérieurs aigus, bicarénés. Elytres de la même largeur que le pronotum, graduellement atténués, tronqués au sommet, ponctués-striés. Dessous noir. Pattes jaunes.

Iles Philippines: Mont Makiling, Laguna, avril-mai 1931 (F. C. Hadden). Whitehead l'a également pris autrefois à Luzon.

Voisin de *M. maceratus* Candèze, plus petit, plus noirâtre; pronotum plus parallèle; stries des élytres mieux marquées.

Neodiploconus haddeni nov. sp.

Long. 9 à 12 m/m—Allongé, peu convexe; noir brillant, pronotum sanguin, parfois noirâtre sur le bord antérieur et au sommet des angles postérieurs; pubescence jaunâtre. Tête convexe, arrondie et rebordée en avant; ponctuation forte et peu serrée. Antennes ferrugineux; 2e et 3e articles petits. Pronotum plus long que large, légèrement et graduellement rétréci en avant, peu convexe, sillonné au milieu en arrière; ponctuation très fine et écartée, un peu plus forte en avant; angles postérieurs aigus et bicarénés. Ecusson rouge ou noirâtre. Elytres graduellement atténués

(tronqués au sommet chez la ♀), presque lisses, très légèrement ponctués-striés, nullement vers le bout. Dessous et pattes sanguins.

Iles Philippines: Mont Makiling, Laguna, 400 ft, avril 1931 (F. C. Hadden); Baguio, juin 1917 (F. X. Williams); Baguio-Benguet (Baker).

Plus étroit que *N. melanopterus* Candèze, 1864, de Sumatra; front moins fortement ponctué, à peine prolongé en avant; ponctuation du pronotum beaucoup plus fine; élytres indistinctement striés; dessous sanguin.

Neodiploconus marginatus nov. sp.

Long. 11 à 13 m/m—Allongé, peu convexe; rouge ferrugineux brillant, élytres bordés de noirâtre; pubescence jaune. Tête convexe, arrondie et rebordée en avant, fortement et densément ponctuée. Antennes minces, ferrugineuses; 3e article à peine plus long que le 2e, beaucoup plus court que le 4e. Pronotum plus long que large, légèrement et graduellement rétréci en avant; ponctuation un peu moins grosse et moins serrée que sur la tête; angles postérieurs aigus, divergents, bicarénés. Elytres graduellement atténués en arrière, finement pointillés et légèrement ponctués-striés. Dessous ferrugineux. Pattes plus claires.

Baguio, juin 1917 (F. X. Williams); Baguio-Benguet (Baker).

Voisin de *N. ciprinus* Candèze; plus étroit, plus brillant, plus légèrement ponctué; élytres très légèrement striés, bordés de noir.

Hawaiian Collembola

BY J. W. FOLSOM, U. S. BUREAU OF ENTOMOLOGY.

(Presented by R. H. Van Zwaluwenburg at the meeting of Nov. 5, 1931)

The main purpose of this paper is to provide the entomologists of Hawaii with names for the Collembola of their pineapple and sugar cane soils. Some of these insects are known to damage the roots of those plants.

This article deals with twenty-seven species, of which eighteen are new. One new variety and two new genera, Stachia and Denisia, are described.

Hitherto the only Collembola known from Hawaii have been the five species described by Dr. G. H. Carpenter. The present considerable additions to the Hawaiian fauna are due mostly to the active interest of Mr. R. H. Van Zwaluwenburg.

Most of the type material upon which this paper is based has been deposited with the Hawaiian Entomological Society, Honolulu. In addition, specimens of most of the species have, by permission, been given to the U. S. National Museum.

A considerable proportion of these Hawaiian forms have their nearest allies in the East Indies, India and China, and a few of the species are cosmopolitan in distribution.

At present it is impossible to name species of Collembola as being endemic to the Hawaiian Islands, on account of our insufficient knowledge of the collembolan faunae of other regions. The non-endemic species may have been brought to the Islands by natural or by artificial means. Some idea of the extent to which Collembola are distributed commercially (most commonly in shipments of plants or plant products, and especially in soil) may be gathered from the fact that the Plant Quarantine and Control Administration (formerly the Federal Horticultural Board) has intercepted, through its inspectors at ports of the United States, thousands of specimens of Collembola, representing hundreds of species; these from all parts of the world.

In the descriptions that follow a few often-used expressions have been abbreviated. *Ant. 1,* for example, means the first an-

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tennal segment; *th. 2,* the second thoracic segment; *abd. 3,* the third abdominal segment.

The keys that follow are limited in scope to the known species of Hawaiian Collembola, including those described by Carpenter.

SYNOPSIS OF THE LARGER GROUPS OF THE ORDER COLLEMBOLA

1. Body elongate, segmentation evident. Suborder ARTHROPLEONA 2
   Body globular, segmentation obscure. Suborder SYMPHYPLEONA 9
2. Body segments essentially similar; prothorax similar to the other segments and with setae dorsally; never reduced or naked. Postantennal organ usually present. Antennae short, four-segmented. Mouth parts biting or piercing-suctorial. Unguiculus frequently absent. Furcula present or absent; when present, clearly appended to the fourth abdominal segment. Manubrium without setae ventrally. Anal spines often present. Integument tuberculate, weak, not hardened in the form of sclerites. Scales absent. Family PODURIDAE.......... 3
   Body segments usually dissimilar; prothorax usually reduced, always membranous, without dorsal setae, and usually partly or entirely covered by the mesonotum. Postantennal organs present in Isotominae, absent in the other groups. Antennae usually long, four to six segmented. Mouth parts biting, Furcula present with few exceptions, often appended apparently to the fifth abdominal segment. Manubrium usually with setae or scales ventrally. Anal spines rarely present. Integument usually smooth, and hardened to form sclerites. Tergites usually imbricate. Scales present or absent. Family ENTOMOBRYIDAE 6
3. Head and body without pseudocelli. Eyes present or absent. Postantennal organ usually present. Unguiculus present or absent. Furcula present or absent. Sense organ of ant. 3 with sense rods, but without sense clubs and outer papillae.......... 4
   Head and body with pseudocelli. Eyes absent. Postantennal organs almost always present and well developed. Mouth parts biting; mandibles with molar surface. Furcula absent or rudimentary. Sense organ of ant. 3 with sense rods, sense clubs, and often with outer papillae with guard setae. Anal spines usually present. Subfamily ONYCHIURINAE.........., p. 57
4. Mouth parts biting, not projecting in a cone; mandibles with molar surface. Furcula present. Anal spines usually present. Subfamily ACHORUTINAE ...., p. 53
   Mouth parts biting or piercing-suctorial, projecting in a cone in most of the genera; mandibles small or absent, without molar surface. Subfamily NEANURINAE.......... 5
5. Anal segment relatively small; supra-anal valve rounded, not bilobed. Furcula present or absent. Segmental tubercles absent. Tribe PSEUDACHORUTINI ...., p. 55

Anal segment relatively large; supra-anal bivalve bilobed. Unguiculus absent. Furcula absent. Segmental tubercles present. Buccal cone present. Anal spines absent. Tribe NEANURINI........., p. 56

6. Postantennal organs almost invariably present (absent in *Isotoma minor*). Third and fourth abdominal segments not greatly different in median dorsal length. Mesonotum not projecting over the head. Inner margin of unguis simple. Scales absent. Body setae simple; occasionally unilaterally feathered. Subfamily ISOTOMINAE ...., p. 58

Postantennal organs absent. Fourth abdominal segment much longer than the third. Mesonotum often projecting over the head. Inner margin of unguis split. Scales present or absent. Body setae of various types, including setae finely fringed on all sides. Subfamily ENTOMOBRYINAE.................................... 7

7. Dentes slender, dorsally annulated. Mucro short, relatively small, with apical tooth, anteapical tooth and basal spine; or falcate. Tribe ENTOMOBRYINI ...., p. 64

Dentes not dorsally annulated.................................... 8

8. Dentes without two rows of dorsal feather-like scales. Mucro robust, with dissimilar inner and outer margins. Antennae unusually long. Eyes present. Tribe PARONELLINI...................., p. 71

Dentes with two rows of dorsal feather-like scales. Mucro elongate, slender, with similar margins. Antennae relatively short. Eyes absent. Scales present. White species. Tribe CYPHODERINI ...., p. 71

9. First four abdominal segments ankylosed. Antennae inserted on the posterior half of the head, and longer than the head. Family SMINTHURIDAE 10

10. Vesicles of ventral tube with smooth walls. Thoracic segmentation indicated dorsally. Subfamily SMINTHURIDINAE..........., p. 72

Vesicles of ventral tube with tuberculate walls. Thoracic segmentation absent.................................... 11

11. Antennae bent between segments three and four. Ant. 4 longer than ant. 3, and subsegmented. Subfamily SMINTHURINAE......, p. 73

Antennae bent between segments two and three. Ant. 4 shorter than ant. 3; both, or only the fourth segment, subsegmented. Subfamily DICYRTOMINAE...................................., p. 74

Subfamily ACHORUTINAE Börner

KEY TO GENERA

Furcula well developed. Eyes sixteen. Postantennal organs present. ....SCHÖTTELLA, p. 54

Furcula small. Eyes ten. Postantennal organs absent...............XENYLLA, p. 54

Genus SCHÖTTELLA Schäffer

Schöttella alba new species. (Plate 1, figs. 1-4).

White. Eyes (fig. 1) remote from antennae, eight on each side, equal, distant from one another, without pigment. Postantennal organ (fig. 1) with five subequal lobes, forming a rosette. Mandibles present, with well-developed molar surfaces. Antennae shorter than the head, with several olfactory setae (fig. 2). Unguis (fig. 3) untoothed. Unguiculus absent. Tenent hairs absent. Dens (fig. 4) with three dorsal setae. Mucro (fig. 4) about one-third as long as dens, stout, in lateral aspect rounded apically, with broad rounding inner lamella. Anal spines absent. Clothing of very few short stiff setae, in two transverse rows on most of the body segments. Integument tuberculate. Length, 0.8 mm.

Honolulu, October 8, 1927, from pineapple roots (J. F. Illingworth).

Genus XENYLLA Tullberg

Xenylla sensilis new species. (Plate 1, figs. 5-13).

Dorsally mottled with blue pigment; ventrally pale. Eyes (fig. 5) five on each side, on black patches. Postantennal organs absent. Antennae shorter than the head (as 9:13). Ant. 3 organ (fig. 6) with a pair of clavate papillae under a tuberculate, rounded, integumentary fold and between a pair of slightly curving accessory horns, each of which is subtended by a seta. Ant. 4 with distal sensory cones as in figure 7. Unguis (fig. 8) apparently unidentate in lateral aspect; actually with a pair of teeth side by side as in figure 9. Tenent hairs 1, 2, 2. Anal spines (fig. 10) minute. Dens (fig. 11) with two dorsal setae. Mucro (figs. 11, 12) seven-tenths as long as dens, distally produced and slightly curving, apically rounded; lamella broad, terminating before the apex. Rami of tenaculum tridentate. Body setae (fig. 13) few, minute, simple. Integument tuberculate. Length, 0.8 mm.

This species is near *X. welchi* Folsom (1916, p. 497) from which it differs chiefly in the structure of the antennal sense organs.

Honolulu, October 4, 1928, pineapple soil (J. F. Illingworth).

Xenylla alba new species. (Plate 2, figs. 14-20).

White. Eyes (fig. 14) five on each side, on black spots; ocular pigment sparse. Postantennal organs absent. Antennae two-thirds as long as the head. Ant. 3 organ (fig. 15) with a pair of elongate rods and two guard setae. Ant. 4 with distal sensory cones as in figure 16; olfactory setae slender, curving, not much differentiated from the other setae. Unguis (fig. 17) stout, curving, untoothed. Tenent hairs 1, 2, 2. Anal spines (fig. 18) minute. Dens with two setae. Mucro (figs. 19, 20) from one-half to three-fourths as long as dens, distally produced and curving upward, apically rounded; inner lamella broad, ending before the apex. Body setae very few, minute, curving, simple. Integument tuberculate. Length, 0.8 mm.

Honolulu, October 8, 1927, among pineapple roots (J. F. Illingworth).

Tribe PSEUDACHORUTINI Börner

Genus STACHIA new genus

(Plate 2, figs. 21-26; Plate 3, figs. 27-30)

Elongate, minute. Eyes reduced in number. Postantennal organ trilobed. Antennae shorter than the head, conical, four-segmented. Ant. 4 with a terminal sensory tubercle. Buccal cone present. Mouth parts piercing. Body segments not demarcated from one another by sutural lines. Prothorax not reduced. Anal segment simple, rounded; anus caudal; anal valves subtriangular in outline. Unguiculus absent. Furcula rudimentary. Integument tuberculate. Large segmental tubercles absent. Genotype, *Stachia minuta* Folsom.

This generic description, being based on a single species, may need future modification.

This peculiar genus belongs in Pseudachorutini but comes close to none of the described genera of that tribe. Its trilobed postantennal organs are like those of Xenyllodes and its mandibles and maxillae are similar in plan to those of Micranurida (Börner, 1901, p. 703). The maxilla is exactly like that of *Neanura* (*Achorutes*) *muscorum* (Folsom, 1916, pl. 23, fig. 225) except in having a relatively shorter head.

On the whole, the genus may be placed near Micranurida.

This new genus is named for Dr. Jan Stach, the esteemed Polish authority on Collembola.

Stachia minuta new species. (Plate 2, figs. 21-26; Plate 3, figs. 27-30).

White throughout, elongate (fig. 21), minute, with intersegmental grooves instead of sutures. Eyes consisting of a single cornea on each side of the head, close to the base of the antenna (fig. 22) and without pigment. Close to each eye is the trilobed postantennal organ (fig. 23) situated in a pit formed by an integumentary ridge. Antennae less than half as long as the head, stoutly conical, four-segmented. Ant. 4 with a terminal sensory tubercle; special olfactory setae absent. Buccal cone present, broadly triangular in ventral aspect. Mouth parts piercing; mandible distally (fig. 24) semi-sagittate, with a sharply pointed apex and a sharp subapical barb like that of a fishook; secondary teeth absent; maxilla (fig. 25) with a simple piercing apex. Body segments in relative lengths about as 12 : 20 : 18 : 14 : 13 : 12 : 13 : 11 : 8; prothorax relatively large; anal segment (fig. 26) simple, rounded, without anal spines; anus caudal; anal valves (fig. 27) subtriangular in outline. Legs short and stout. Unguis (fig. 28) stout, subfalcate, untoothed. Unguiculus absent. Tenent hairs absent. Ventral tube small, with a pair of hemispherical vesicles side by side. Furcula present but greatly reduced (figs. 29, 30), being a simple bilobed organ in

which manubrium, dentes and mucrones are not demarcated from one another. Tenaculum apparently absent. Body setae very few, minute, short and stiff, in a single row across the middle of most of the body segments, being rather numerous and larger on the genital and anal segments. Integument tuberculate, the tubercles becoming larger and irregular on the genital and anal segments. Large segmental tubercles absent. Length, 0.5 mm.

Wahiawa, Oahu, July 12, August 12, October 2, 4, 1928, abundant deep in pineapple soil with Onychiurus, Japyx, Symphyla, etc. (J. F. Illingworth); Honolulu, in many soil samples (R. H. Van Zwaluwenburg); Tantalus, Oahu, August 4, 1930, soil in native forest, 1700 ft. (R. H. Van Zwaluwenburg and F. A. Bianchi).

Cotypes.—Cat. No. 43764, U. S. N. M.

Tribe NEANURINI Börner

KEY TO GENERA

Head of maxilla with toothed lamellae .... PROTANURA
Head of maxilla needlelike, without lamellae .... NEANURA

Genus PROTANURA Börner

Protanura capitata new species. (Plate 3, figs. 31-36).

White (fig. 31). Head with a postero-lateral tubercle on each side. Eyes and postantennal organs absent. Antennae a little shorter than the head. Ant. 3 and 4 confluent dorsally but demarcated by a suture ventrally. Ant. 3 organ (fig. 32) simple, with a pair of ovate papillae. Ant. 4 with distal olfactory setae as in figure 33. Buccal cone present. Mandible distally (fig. 34) with large teeth, laciniate appendage and long linear stalk. Head of maxilla (fig. 35) with coarsely toothed galea and finely toothed lacinial membranes. Segmental tubercles in dorsal aspect: 6, 8, 8, 8, 8, 8, 6, 4, 2; the dorsal tubercles much less prominent than in figure 31. Unguis (fig. 36) with a pair of inner teeth side by side, one-third from the base. Tenent hairs absent. Anal spines and furcula absent. Anus ventral. Clothing of short simple setae and long capitate hairs. Integument tuberculate, not reticulate. Length, 3 mm.

This species is quite distinct from the four other species of Protanura.

Honolulu, September 13, 1930 (Walter Carter).

Genus NEANURA MacGillivray

Neanura citronella Carpenter.

See Carpenter, 1904, p. 303.

Subfamily ONYCHIURINAE Börner

KEY TO GENERA

Body stout or moderately slender, head broad. Tubercles of postantennal organ usually not numerous. Sense clubs of ant. 3 smooth or tuberculate, not bending toward each other. Unguiculus well developed. ....ONYCHIURUS

Body quite slender, head narrow. Tubercles of postantennal organ usually numerous. Sense clubs of ant. 3 smooth, bending toward each other. Unguiculus reduced and setaceous, or absent. .. ..TULLBERGIA

Genus ONYCHIURUS Gervais

Onychiurus fimetarius (L., Lubb.).

For a description of this species see Folsom, 1917, p. 649.

The Hawaiian specimens of this species agree accurately with examples from Europe and North America. The species, common throughout Europe and widely distributed in North America, is known also from Algeria, Sumatra, and China.

Olaa, Hawaii, soil in sugar cane fields (R. H. Van Zwaluwenburg).

Genus TULLBERGIA Lubbock

Tullbergia silvicola new species. (Plate 4, figs. 37-41).

White. Slender (fig. 37), six times as long as broad. Postantennal organs (fig. 38) subelliptical, each with about 60 tubercles. Pseudocelli large, thick-walled. Head with a pseudocellus just in front of each postantennal organ. Antennal base not differentiated. Antennae two-thirds as long as the head; third and fourth segments confluent. Ant. 3 organ (fig. 39) with four guard setae, two minute sense rods, and two subreniform smooth sense clubs curving toward each other. Ant. 4 with six or more strongly curving olfactory setae. Body with a pair of dorsal pseudocelli on segments th. 2 to abd. 5, inclusive (fig. 37). Unguis (fig. 40) stout, curving, untoothed. Unguiculus rudimentary, spiniform. Anal spines (fig. 41) two, slender, arcuate, four-fifths as long as hind unguis, on contiguous papillae. Clothing of minute stiff simple setae; the sensory setae longer. Integument tuberculate. Length, 0.7 mm.

In the pseudocelli of the head the wall is often interrupted, as in figure 38.

Tantalus, Oahu, August 4, 1930, soil in native forest, 1700 ft. (R. H. Van Zwaluwenburg and F. A. Bianchi).

Subfamily ISOTOMINAE Börner

KEY TO GENERA

1. Body cylindrical, greatly elongate. Prothorax unusually long. Abd. 4 a simple ring. Terga not imbricate. Furcula very small. Eyes reduced in number or absent. Postantennal organs long and narrow. Manubrium longer than dentes.................................. 2
   Body not greatly elongate. Prothorax reduced more or less. Abd. 4 modified. Terga imbricate. Furcula not very small..................... 3
2. Genital and anal segments simple, or relatively unmodified, without ankylosis. Anus not ventral. Manubrial hooks not strongly developed. Integument smooth.......................................FOLSOMIDES, p. 58
   Genital and anal segments modified, shortened, ankylosed. Anus ventral. Manubrial hooks strongly developed. Integument granulate..ISOTOMODES, p. 59
3. Last three abdominal segments ankylosed, forming a single mass. Anus ventro-caudal. Eyes reduced in number or absent. Body pigment weak or absent.. 4
   Last three abdominal segments not ankylosed. Anus caudal. Eyes usually sixteen. Pigment commonly well developed....................... 5
4. Mucro bidentate. Ant. 4 without sense clubs.....................FOLSOMIA, p. 60
   Mucro falcate. Ant. 4 with sense clubs.................................DENISIA, p. 61
5. Third abdominal tergite shorter than the fourth, and not ventrolaterally prolonged backward. Furcula not attaining the ventral tube...PROISOTOMA, p. 62
   Third abdominal tergite longer than the fourth, and ventrolaterally prolonged backward. Furcula attaining the ventral tube............ 6
6. Abdominal fringed bothriotricha present. Mucrones lamellate. ....ISOTOMURUS, p. 63
   Bothriotricha absent. Mucrones not lamellate........................ ISOTOMA, p. 63

Genus FOLSOMIDES Stach

Folsomides exiguus new species. (Plate 4, figs. 42-47).

White. Greatly elongate (fig. 42). Eyes two on each side, pigmented separately, one behind the other, the posterior eye being the smaller. Postantennal organ (fig. 43) near the anterior eye, elongate, six to seven times as long as broad, feebly curving, with three or four posterior guard setae; from two-thirds to one and one-third times as long as the basal width of ant. 1. Antennae two-thirds as long as the head, with stout segments in relative lengths about as 16 : 24 : 25 : 42. Sense organ of ant. 3 with a pair of papillae, each arising from the bottom of a deep pit. Ant. 4 with several slender curving olfactory setae, without terminal tubercle. Mandible with a molar surface (fig. 44). Body segments in relative lengths about as 9 : 32 : 27 : 23 : 23 : 23 : 25 : 18 : 17; or 10 : 34 : 28 : 20 : 23 : 24 : 29 : 20 : 18. Body segments without ankylosis. Anus caudal. Unguis (figs. 45, 46) stout, curving, simple, untoothed. Unguiculus of hind feet (fig. 45) lanceolate, acuminate, extending about one-fourth as far as the unguis; on fore and mid-feet, a minute pointed rudiment (fig. 46). Tenent

hairs absent. Ventral tube with a pair of hemispherical vesicles, side by side. Furcula small, appended evidently to abd. 4, and extending only slightly beyond the anterior border of that segment. Manubrium (fig. 47) stout, with four pairs of dorsal setae, without ventral setae. Mucrodentes (fig. 47) three-fourths or three-fifths as long as manubrium, with three dorsal setae, no ventral setae, and minutely bidentate: apical tooth hooked; anteapical tooth larger, erect or inclined slightly forward. Rami of tenaculum tridentate; corpus with a small median anterior lobe and one seta. General clothing of a few rows of short stiff simple setae in the middle region of most of the body segments; sensory setae longer, erect, simple. Integument smooth. Maximum length, 0.7 mm.

This new species differs in many respects from the genotype, *F. parvulus* Stach (1922, p. 17), from Hungary.

Honolulu, March 25, 1925, in sugar cane soil; November 26, 1928, in rice soil (R. H. Van Zwaluwenburg); October 8, 1927, in pineapple soil (J. F. Illingworth); Tantalus, Oahu, August 4, 1930, in soil in native forest, 1700 ft. (R. H. Van Zwaluwenburg and F. A. Bianchi).

Cotypes.—Cat. No. 43765, U. S. N. M.

Genus Isotomodes Axelson

Isotomodes denisi new species. (Plate 5, figs. 48-56).

White throughout. Very elongate (fig. 48). Eyes absent. Postantennal organs (fig. 49) elliptical, three times as long as wide, three-fourths as long as the basal width of ant. 1, with guard setae as in figure 49, there being none near the anterior border of the organ. Antennae slightly longer than the head, with segments about as 4 : 5 : 6 : 9. Sense organ of ant. 3 consisting of a pair of sacs, the walls of which are circular in deep optical cross-section (fig. 50), and shaped like the figure 8 at the level of the integument (fig. 51). Each sac contains a single papilla (fig. 52) and is covered externally by a hemispherical tubercle. Ant. 4 with several (at least 5) curving olfactory pegs (fig. 52), without a terminal tubercle and without a subapical papilla. Mandibles and maxillae as in figures 53 and 54. Prothorax relatively long. Genital and anal segments ankylosed, with a short obsolete dorsal suture. Body segments in relative lengths about as 9 : 22 : 20 : 14 : 13 : 16 : 20 : 5+6. Anus ventral. Femora with a partial distal subsegment, the transverse suture being limited to the lower side of the femur. Unguis (fig. 55) stout, almost straight, untoothed. Unguiculus extending almost half as far as the unguis, oblong-lanceolate and acute on the hind feet, smaller and more sharply pointed on the other feet. Tenent hairs absent. Ventral tube with a pair of rounded vesicles side by side. Furcula small, extending only to the middle of abd. 3. Manubrium stout, longer than dentes (as 4 : 3 or 5 : 3), ventrally naked, dorsally with many stiff setae (20 or more). Manubrial hooks strongly developed (fig. 56). Dens (fig. 56) not annulate; dorsally with only two setae, situated near the base of the dens and erect, the proximal

seta long and strong, and the distal seta much smaller; dens ventrally with only one seta as a rule, rarely with two or three; manubrial hooks strongly developed. Mucrones (fig. 56) one-third as long as dentes, three-quarters as long as hind ungues, bidentate; anteapical tooth larger than the apical. Rami of tenaculum tridentate; corpus with one strong curving anterior seta. General clothing of a few rows of short stiff simple setae across the middle region of a body segment, being abundant and stronger at the end of the abdomen; sensory setae longer, erect, simple, in a single transverse row on most of the body segments. Integument smooth. Maximum length, 1.7 mm.

This species differs in several respects from *Isotomodes productus* Axels., known from Finland, Russia, France, England and Morocco. *I. productus* (Linnaniemi, 1912, p. 107; Denis, 1923, p. 243; Handschin, 1925*a*, p. 164) is described as having at least 14 or 15 olfactory setae on ant. 4; postantennal organ longer than the basal width of ant. 1, and with 6 posterior and 3 anterior guard setae; abd. 3 and 4 equal in length; dens with only one ventral seta; mucro one-fourth as long as dens; integument granulate.

A variety of *productus* was named *trisetosa* by Denis on account of its having three ventral setae on each dens. In this new species different individuals may show one, two, or three such setae, though only one as a rule.

Honokaa, Hawaii, November 5, 1928, in cane soil; Honolulu. abundant in cane soil (R. H. Van Zwaluwenburg); Tantalus, Oahu, August 4, 1930, in soil in native forest, 1700 ft. (R. H. Van Zwaluwenburg and F. A. Bianchi).

This new species is named for Dr. J. R. Denis, known for his exact and thorough studies of Collembola.

Cotypes.—Cat. No. 43766, U. S. N. M.

Genus Folsomia Willem

Folsomia fimetaria (L., Tull.).

My Hawaiian specimens of this species agree with European and North American examples except in having stouter ungues. The postantennal organs, very variable in form and size in this species, are narrowly subelliptical and about as long as the basal width of ant. 1. The specimens are all young individuals, being only 1 mm. in length.

For a description of this species see Folsom, 1902, p. 92.

This cosmopolitan species belongs to the fauna of the soil, being often found among the roots of plants, under damp wood, stones or bark, in moss, and not infrequently on well water. It occurs often in flowerpots in dwelling houses or greenhouses, having been brought in with the soil; and has been found in caverns and graves.

F. fimetaria is one of the commonest collembolans in northern and middle Europe and in the United States, in all parts of which it occurs, including California and Alaska. It is known also from Siberia, Spitzbergen, Franz Josef Land, Greenland, Mexico and Guatemala. It has often been intercepted in ports of this country by inspectors of the Plant Quarantine and Control Administration.

Honokaa and Olaa, Hawaii, soil in sugar cane fields (R. H. Van Zwaluwenburg).

Genus Denisia new genus

(Plate 5, fig. 57; Plate 6, figs. 58-62)

Fourth, fifth, and sixth abdominal segments ankylosed, forming a single mass. Anus ventro-caudal. Mucrones falcate. Eyes and postantennal organs absent. Ant. 4 with relatively large sense clubs. Unguis and unguiculus untoothed. Tenent hairs absent. Body setae simple. Integument smooth. Genotype, *Denisia falcata* Folsom.

This new genus is evidently close to *Folsomia* Willem, from which it differs chiefly in having falcate mucrones and antennal sense clubs and in lacking postantennal organs. I dedicate it with pleasure to my colleague, Dr. J. R. Denis.

Denisia falcata new species. (Plate 5, fig. 57; Plate 6, figs. 58-62).

White (fig. 57). Eyes and postantennal organs absent. Antennae subequal to head in length, to one-fourth longer than head. Ant. 3 organ with a pair of small tubercles in a shallow depression. Ant. 4 with five or six distal dorso-lateral sense clubs (fig. 58) and a terminal tubercle. Mandibles with a well developed molar surface. Imbrication of body segments weak. Abd. 4, 5, and 6 ankylosed, without sutures in some individuals, but usually with an obsolete dorsal suture between abd. 4 and 5. Anus ventro-caudal. Unguis (fig. 59) simple, untoothed. Unguiculus extending about one-half as far as the unguis, broadly lanceolate, acute, untoothed. Knobbed tenent hairs absent. Furcula extending not quite to the ventral tube. Manubrium ventrally with five pairs of distal setae. Manubrial hooks not developed; there being two pairs of narrow chitinous ridges. Dens (fig. 60) slightly more than twice as long as manubrium, slender, tapering, crenulate dorsally on proximal half only; with very long ventral subapical seta; basodorsally with a long erect seta just anterior to a short seta. Mucrones (fig.

61) falcate. Rami of tenaculum quadridentate; corpus with one anterior seta, sometimes a pair of setae. Clothing (fig. 62) of abundant, short, stiff, simple setae, with long erect simple sensory setae; with a few long unilaterally fringed setae on the ankylosed abdominal segments. Integument smooth. Length, 0.65 mm.

Honolulu, January 7, 1927, in cane soil. April 5, 1927, from débris in nest of *Coptotermes formosanus* Shiraki (R. H. Van Zwaluwenburg).

Cotypes.—Cat. No. 43767, U. S. N. M.

Genus Proisotoma Börner

Proisotoma nigromaculosa new species. (Plate 6, figs. 63-66).

White, minutely and irregularly flecked with blackish blue, giving a pale grayish appearance. Antennae bluish throughout, or spotted with blackish; ant. 4 dark apically. Legs white with pigmented coxae, or spotted throughout with blackish. Furcula unpigmented. Antennae subequal to head in length, or slightly longer, with segments about as 4 : 5 : 6 : 9 or 7 : 13 : 12 : 23. Ant. 3 organ with a pair of simple rods subtended by a chitinous ridge. Ant. 4 with a terminal sensory tubercle and without specially differentiated olfactory setae. Eyes eight on each side (fig. 63), subequal, on black patches. Postantennal organ elliptical to subreniform, with or without an anterior notch at the middle, and three to three and one-half times as long as the diameter of an adjacent eye. Abd. 3 shorter than abd. 4 (as 5 : 6). Genital and anal segments usually not ankylosed, sometimes partially ankylosed. Tibiotarsi with an incomplete distal subsegment, indicated by a suture on the lower side. Unguis (fig. 64) untoothed. Unguiculus sublanceolate, untoothed, or with an inner tooth or angle, and extending from almost one-half to two-thirds as far as the unguis. Tenent hairs absent. Furcula not attaining the ventral tube; extending to the middle of abd. 2. Manubrium with one pair to three pairs of ventral subapical setae. Dentes one-third longer than manubrium, with coarse transverse dorsal folds, absent proximally and distally. Mucro (figs. 65, 66) subequally bidentate. Rami of tenaculum quadridentate; corpus with one anterior seta. Clothing of short, stiff, simple setae in the middle region of most of the body segments, absent in the intersegmental regions, with longer erect simple sensory setae. Integument smooth. Length, 0.9 mm.

This species is somewhat like the European *Proisotoma ripicola* Linnaniemi (1912, p. 128), from which it differs, however, in coloration, in having relatively much longer dentes, and in several other details.

Pupukea, Oahu, October 1, 1928, in pineapple soil (J. F. Illingworth); Honolulu, November 26, 1928, in rice soil (R. H. Van Zwaluwenburg).

Genus Isotomurus Börner

Isotomurus palustris (Müller), var. **balteatus** (Reuter).

The Hawaiian examples of this variety are typical in structure and coloration. For a description, see Schött, 1894, p. 66.

I. palustris is a common cosmopolitan species, highly variable in coloration. Its variety *balteatus* is known from Europe, many parts of the United States, including California, and from British West Indies and Bismarck Archipelago.

Honolulu, sugar cane soil, near the surface under trash, "78 per surface square foot" (R. H. Van Zwaluwenburg); Kauai, soil in sugar cane fields (R. H. Van Zwaluwenburg).

Genus Isotoma Bourlet

KEY TO SPECIES

Purplish yellow. Eyes sixteen. Tenent hair one.......... .... *perkinsi*
White. Eyes, postantennal organs, and tenent hairs absent .... *minor*

Isotoma perkinsi Carpenter.
See Carpenter, 1904, p. 302.

Isotoma minor Schäffer. (Plate 6, figs. 67-71).

White throughout. Eyes and postantennal organs absent. Antennae about one-fourth longer than the head, with segments about as 3 : 7 : 7 : 10; third and fourth segments subclavate. Ant. 4 with six or seven relatively large olfactory cones or pegs, as in figures 67 and 68. Abd. 3 usually a little shorter than abd. 4 (as 9 : 11); sometimes subequal to it. Abd. 5 and 6 usually, but not always, ankylosed; anal valves large. Unguis (fig. 69) rather slender, untoothed. Unguiculus extending two-thirds as far as the unguis on the hind feet; about half as far on the remaining feet; broadly lanceolate, acute, untoothed. Tenent hairs absent. Furcula extending not quite to the ventral tube. Manubrium with several stiff dorsal setae and four to ten ventral subapical setae. Dens two and one-half times as long as manubrium, with a few erect dorsal setae and stiff oblique ventral setae; dorsally minutely crenulate on the proximal four-sevenths only. Mucro (fig. 70) tridentate; apical tooth slender; anteapical tooth erect; basal tooth lateral, spinelike; dens with a long lateral subapical seta. Rami of tenaculum quadridentate; corpus with one anterior seta. General clothing of rather long, stiff or curving, simple setae (fig. 71); outstanding sensory setae of abdominal segments much longer, doubly fringed, stronger on the posterior region of the abdomen. Length, 0.91 mm.

The Hawaiian examples of *I. minor* agree with European and North American representatives of the species in every detail except that in the Hawaiian specimens ant. 1 is relatively shorter, and the baso-lateral tooth of the mucro is slender and spinelike instead of being short and blunt.

I. minor, a species of the soil fauna, has been recorded from almost all parts of Europe, from the United States and from Mexico.

Honolulu, January 7, 1927, in cane soil (R. H. Van Zwaluwenburg).

Tribe ENTOMOBRYINI Börner

KEY TO GENERA

1. Body without scales 2
   Body with scales 3
2. Ungues with simple inner teeth. Tenent hair strongly developed. .... ENTOMOBRYA, p. 64
   Ungues with large inner "wing-teeth." Tenent hair weak. .... SINELLA, p. 66
3. Scales pointed apically, with long coarse striae. Dentes without scales. .... SIRA, p. 66
   Scales rounded apically, with short fine close striae. Antennae not annulated 4
4. Mucro with two teeth and a basal spine .... LEPIDOCYRTUS, p. 67
   Mucro falcate. .... DREPANOCYRTUS, p. 69

Genus ENTOMOBRYA Rondani

KEY TO SPECIES

1. White throughout .... *lactea*, p. 65
   Yellow with purple markings 2
2. Transversely banded .... *multifasciata*, p. 64
   Not banded 3
3. Yellow with lateral purple stripes. Tenent hair present. Mucro with basal tooth .... *insularis*, p. 64
   Yellow with complex purple markings. Tenent hair and basal tooth absent .... *kalakaua*, p. 64

Entomobrya insularis Carpenter.
See Carpenter, 1904, p. 301.

Entomobrya kalakaua Carpenter.
See Carpenter, 1904, p. 301.

Entomobrya multifasciata (Tullberg), var. **imminuta** new variety. (Plate 7, figs. 72-75).

Yellow with transverse bands (fig. 72). The pigment is purple, appearing black where it is dense. Prothorax pigmented dorsally; mesonotum with an anterior band extending laterally, and a posterior marginal band; metanotum with a posterior band and a lateral marginal spot; first three abdominal segments each with a broad posterior band; abd. 4 with two dorsal bands, the posterior one being marginal; abd. 5 with a posterior

band; abd. 6 pigmented dorsally. Head with an irregular median frontal spot; behind this a V-shaped mark; occiput with a dorsal marginal mark. Antennal base blackish; ant. 1 and 2 each with an apical spot; ant. 3 dull purplish except basally; ant. 4 dull purplish throughout. First pair of legs unpigmented except on the precoxae; second and third pairs each with precoxal spots and a distal femoral spot. Furcula unpigmented. Eyes (fig. 73) sixteen, the two inner proximal eyes of each side smaller than the others. Antennae more than twice as long as the head. Body segments (omitting the prothorax) in relative lengths about as 20 : 21 : 19 : 18 : 19 : 25 : 12 : 7 or as 28 : 23 : 17 : 22 : 20 : 47 : 13 : 9. Unguis (fig. 74) stout, almost straight; inner border with a pair of large proximal teeth one-third from the apex, and a smaller distal pair. Unguiculus oblong-lanceolate, extending about two-thirds as far as the unguis. Tenent hair about as long as the unguis. Dentes slightly longer than the manubrium, the dorsal crenulations ending at a distance from the apex equal to three times the length of the mucro. Mucro (fig. 75) in lateral aspect strongly rounded ventrally, the anteapical tooth relatively low and broadly conical. Rami of tenaculum quadridentate; corpus with one strong curving anterior seta. Length, 1.6 mm.

In coloration this form agrees essentially with *multifasciata* Tull., a common species in Europe and North America. As compared with typical *multifasciata*, however, abd. 4 is relatively much shorter; the antennae relatively much longer; the proximal pair of teeth of the unguis is beyond the middle; and the two inner proximal eyes of each side are greatly reduced.

The posterior marginal bands of th. 2 to abd. 3, inclusive, are either continuous or else more or less interrupted along the median dorsal line—a variation that is common in *multifasciata*, both in Europe and North America.

In one individual the mid intestine contained an abundance of fungus spores and fragments of hyphae, the latter predominating.

Pupukea, Oahu, October 1, 1928, in pineapple soil (J. F. Illingworth).

Entomobrya lactea new species. (Plate 7, figs. 76-78).

Head and body usually white throughout, excepting the black eye spots and frontal ocellus. The largest individuals may have a narrow weak posterior purple band on abd. 1, 2, 3, 5 and 6. Ant. 1 and 2 purple apically, or ant. 1 unpigmented; ant. 3 pigmented apically or throughout; ant. 4 purple throughout. Femora pigmented apically; tibiotarsi throughout. Furcula unpigmented. Eyes (fig. 76) sixteen, unequal. Antennae four-fifths longer than the head, with segments about as 12 : 23 : 24 : 28, not annulated. Abd. 4 is two and one-half to three and one-half times as long as abd. 3. Unguis (fig. 77) slender, with two pairs of inner teeth and a pair of lateral teeth. Unguiculus extending about five-eighths as far as the unguis, oblong-lanceolate, acute, untoothed. Tenent hair equal to unguis in

length. Manubrium three-fifths as long as dentes. The non-annulated region of the dens is about one and two-thirds times as long as the mucro. Mucro (fig. 78) minute; apical and anteapical teeth hooked, subequal: basal spine present. Length, 1.3 mm.

Honolulu, September, 1930, behind sugar cane leaf sheaths, in trash, etc. (F. X. Williams).

Cotypes.—Cat. No. 43768, U. S. N. M.

Genus SINELLA Brook

Sinella höfti Schäffer. (Plate 7, figs. 79-81).

White. Eyeless. Antennae longer than the head (as 8 : 5). Abd. 4 two and one-fourth to two and two-thirds times as long as abd. 3. Unguis (fig. 79) with a large acute basal "wing-tooth," posterior in position, (when the leg is in a transverse plane); opposite this is an anterior linear thickening, which may or may not be pointed distally; just beyond this is either a tooth or an angle. A pair of small pseudonychia occurs near the base. Unguiculus extending two-thirds to four-fifths as far as unguis, with a large acute outer wing-tooth. Tenent hair as long as inner margin of unguis, not clubbed. On each tibiotarsus, one-third from the base, is a large subclavate fringed seta (fig. 80). Furcula with scales ventrally. Dens one-fifth longer than manubrium. Mucro (fig. 81) stout, falcate, with long basal spine. Length, 1.1 mm.

The specimens studied were not full grown.

The thickened fringed seta of the tibiotarsi I find in specimens from Iowa also.

As compared with European examples, the wing-tooth of the unguis is wider, and the opposite, or anterior, tooth is greatly narrowed or reduced to a ridge.

This species is known from China (Denis, 1929*b*, p. 311) and a variety of it (*S. coeca edenticulata*) has been described from Java (Handschin, 1926, p. 455). I think that *S. montana* Imms (1912, p. 101) from India is to be regarded as a variety of *höfti*.

Tantalus, Oahu, August 4, 1930, in soil in native forest, 1700 ft. (R. H. Van Zwaluwenburg and F. A. Bianchi).

Genus SIRA Lubbock

Sira jacobsoni Börner. (Plate 8, figs. 82-88).

When denuded of scales, yellow or whitish, marked with blackish purple (figs. 82, 83). Mesonotum pigmented throughout, or nearly so, the band extending to the bases of the coxae. Abd. 2 with a posterior band, sometimes narrow and somewhat irregular (fig. 83). Abd. 3 banded throughout dorsally, or with a narrow anterior unpigmented area. Abd. 4 banded

posteriorly; the band sometimes covering more than half of the dorsum, and always having an irregular anterior margin, often with irregular streaks of pigment projecting forward. Abd. 5 with a postero-dorsal spot, or unpigmented. Head with a median frontal spot, indicating the ocellus. Ant. 1 yellow or white, purple apically; ant. 2 purple apically or throughout; ant. 3 and 4 purple. Fore legs with femur pigmented apically and tibiotarsus pigmented near the middle; middle and hind legs with spots of pigment on the precoxae, the femur apically, and the tibiotarsus beyond the middle. Furcula unpigmented. Eyes (fig. 84) sixteen, unequal, the two inner proximal eyes of each side being small and difficult to distinguish. Antennae a little more than twice as long as the head, with segments about as 12 : 28 : 30 : 41, or 8 : 19 : 16 : 27. Mesonotum not projecting over the base of the head. Abd. 4 about 2.2 to 2.4 times as long as abd. 3. Unguis (figs. 85, 86) with three inner pairs of teeth and a pair of lateral teeth. Unguiculus extending about two-thirds as far as the unguis, oblong-lanceolate. Tenent hair a little longer than unguis. Dens one-fourth longer than manubrium, its dorsal crenulations ending before the apex at a distance equal to twice the length of the mucro. Manubrium and dentes densely setaceous on all sides, without scales ventrally. Mucro (fig. 87) with subequal apical and anteapical teeth. Rami of tenaculum quadridentate; corpus with one strong seta, curving distally. Body scales (fig. 88) pale brown, mostly broadly lanceolate to ovate, apically pointed, with long coarsely spaced parallel striae. Length, up to 2.1 mm.

This description agrees essentially with that of the Javanese species, *Sira jacobsoni* Börner (1913*b*, p. 49). The Hawaiian specimens differ from the description by Handschin (1925*b*, p. 237) in not having a metanotal band and in having relatively longer unguiculi. His material came from Sunda Islands.

Honolulu, May 7, 1928, in pineapple soil (J. F. Illingworth); Oahu, November, 1928, in rice straw (R. H. Van Zwaluwenburg); Wahiawa, December 3, 1928, in pineapple soil (J. F. Illingworth).

Specimens.—Cat. No. 43769, U. S. N. M.

Genus Lepidocyrtus Bourlet

KEY TO SPECIES

1. Mesonotum projecting strongly over the head. Apical tooth of mucro very long and slender. A white species................*heterophthalmus*, p. 68
   Mesonotum not strongly projecting. Apical tooth of mucro short...... 2
2. Iridescent purple or metallic gray................ *cyaneus*, p. 68
   White or pale yellowish................ 3
3. Body white throughout. Abd. 4 three to four times as long as abd. 3 ....*immaculatus*, p. 68
   White or pale yellow when denuded, usually faintly flecked with blue. Abd. 4 one-tenth to six-tenths longer than abd. 3........*inornatus*, p. 68

Lepidocyrtus heterophthalmus Carpenter.

See Carpenter, 1904, p. 300.

Lepidocyrtus cyaneus Tullberg. (Plate 8, figs. 89-91).

The Hawaiian examples of this species agree with European and North American representatives of the species.

Iridescent purple. (Metallic gray in var. *cinereus* Fols.) Denuded of scales the body is purple, with white intersegmental bands. The bases of the legs are purple, but the femora and tibiotarsi are white. Length, 1.1 mm. See figures 89-91.

For full descriptions of this species refer to Folsom, 1919, p. 14, and 1924, p. 9.

L. cyaneus is a common species in most parts of Europe and North America and is known also from Mexico, Greenland, Siberia, Africa and Bismarck Archipelago.

Pupukea, Oahu, October 1, 1928, in pineapple soil (J. F. Illingworth).

Lepidocyrtus inornatus new species. (Plate 9, figs. 92, 93).

White or pale yellow when denuded of scales, and usually weakly and indefinitely flecked and mottled with blue on the head dorsally and laterally and on th. 2 to abd. 5, inclusive. In the largest individuals these segments are broadly banded with blue dorsally. Antennae bluish throughout. Legs and furcula unpigmented, or legs slightly pigmented basally. Eyes sixteen, subequal. Antennae a little longer than the head (as 1.3 : 1), with segments about as 7 : 12 : 13 : 26. Mesonotum projecting slightly over the occiput. Abd. 4 from one-tenth to six-tenths longer than abd. 3. Unguis (fig. 92) with two pairs of inner teeth and a pair of outer teeth. Unguiculus extending as far as the distal teeth of the unguis, oblong, acute, untoothed. Tenent hair as long as unguiculus, weakly knobbed. Dentes slightly longer than manubrium; both with scales ventrally and abundant fringed setae dorsally; non-annulated region of dens two-thirds longer than the mucro. Mucro (fig. 93) relatively elongate, with long basal spine. Rami of tenaculum quadridentate; corpus with one strong curving anterior seta. Length, 1.5 mm.

Honolulu, May 4, 7, 1928, in pineapple soil (J. F. Illingworth).

Lepidocyrtus immaculatus new species. (Plate 9, figs. 94-96).

White throughout, excepting the black eye spots and the median ocellus. Eyes (fig. 94) sixteen, unequal. Antennae from three-tenths to five-tenths longer than the head. Antennal ratios noted were 8 : 17 : 15 : 30; 6: 13 : 11 : 27; 6 : 15 : 14 : 31; third segment shorter than the second. Mesonotum not projecting far over the head. Abd. 4 from three to four times as long as abd. 3. Unguis (fig. 95) with two pairs of inner teeth and a pair of lateral teeth. Unguiculus extending three-fifths as far as the unguis, oblong-lanceolate, acute, untoothed. Tenent hair short, equal to unguiculus in length. Furcula with scales ventrally. Dens slightly longer than manu-

brium; dorsal non-annulated region one and one-half times as long as the mucro. Mucro (fig. 96) with long basal spine. Scales apically rounded. Length, 1.2 mm.

This species differs in only a few details from *L. rivularis* Bourl. var. *albicans* Reut., a common species in Europe (Stach, 1922, p. 32). It lacks the antennal coloration of *albicans*, however; ant. 3 is shorter than ant. 2; abd. 3 is relatively shorter than abd. 4; and the non-annulated region of the dens is much shorter than in *albicans*.

Honolulu, October 8, 1927, among pineapple roots (J. F. Illingworth); Oahu and Maui, in cane soil (R. H. Van Zwaluwenburg).

Cotypes.—Cat. No. 43770, U. S. N. M.

Genus Drepanocyrtus Handschin

Drepanocyrtus terrestris new species. (Plate 9, figs. 97-102; Plate 10, figs. 103, 104).

White when denuded of scales; with scales, brownish. Individuals up to about one millimeter in length are entirely white, excepting the eye spots and antennae. Large individuals (fig. 97) may have the mesonotum bordered anteriorly and laterally with purple, with a purple ventro-lateral patch on th. 3, abd. 1, 2 and 3. These patches may extend dorsally (fig. 98), and in the most heavily pigmented specimens may form dorsal bands. Abd. 4 may or may not be pigmented laterally. A purple spot marks the position of the frontal ocellus. Antennal base often ringed with purple; ant. 1 white, or purple apically; ant. 2 purple apically or throughout; ant. 3 white basally or purple throughout; ant. 4 entirely purple. Legs unpigmented except in the largest individuals, in which all the segments may be tinged with purple, with spots on coxae and precoxae. Furcula unpigmented. Eyes (fig. 99) sixteen, unequal, the two anterior eyes on each side being much larger than the others. Antennae two to two and one-half times as long as the head, or three-sevenths as long as the body, with segments about as 7 : 12 : 14 : 13 or 5 : 7 : 8 : 14; none of the segments annulated. Ant. 4 with a terminal tubercle. Mesonotum not projecting over the head. The body segments vary considerably in relative lengths; abd. 4 from 2.25 to 3.9 times as long as abd. 3. Unguis (fig. 100) with three pairs of inner teeth, a pair of small lateral teeth one-third from the base, and an outer tooth slightly more proximal than the last (fig. 101). Unguiculus extending two-thirds as far as the unguis, sublanceolate, acute, untoothed. Tenent hair a little longer than the inner margin of the unguis. All the tibiotarsi are subsegmented, the proximal subsegment being about twice as long as the distal on the first two pairs of legs, and about two and one-half times as long on the hind legs. Furcula attaining the ventral tube. Dentes about one-fifth longer than the manubrium, coarsely crenulate dorsally, the crenulations stopping abruptly; non-crenulated region twice as long as the mucro (fig. 102). Dentes with dorsal setae and ventral scales. Mucrones (figs. 102, 103)

falcate. Rami of tenaculum quadridentate; corpus with one strong anterior seta. Clavate setae occur dorsally in dense clusters on th. 2 and th. 3, and more sparsely on head and abdomen. Extra long, minutely fringed setae occur on the head, first two antennal segments, and the legs, being abundant on femora and tibiotarsi. Body scales (fig. 104) variable in size and form, but mostly broadly elliptical to oval, apically rounded, and closely covered with fine short striae. Length, 1.7 mm; maximum, 2.1 mm.

Several large individuals of this species, taken in the soil among pineapple roots, were entirely white, excepting the eye spots. Even the scales were white.

This species is close to *Pseudosira pseudocaerulea* Denis (1924*b*, p. 244; 1929*a*, p. 104) from Africa and Madagascar. I sent specimens of it to Dr. Denis, who reported that it differs from that species in lacking the basal tooth of the unguiculus, and in having longer inner teeth on the unguis and a different type of scale ornamentation.

He says, however, that this Hawaiian form is even closer to his Costa Rican *Lepidocyrtinus domesticus* (Nic.) *coloratus* (Denis, 1931, p. 142), from which it differs in lacking the teeth of the unguiculus which are characteristic of *domesticus*.

Besides this difference, the Hawaiian form appears to differ from typical *domesticus* of Europe in the relative sizes of the eyes, and in having relatively shorter antennae and fourth abdominal segment (see Denis, 1924*a*, p. 266).

As Dr. Denis says, we do not at present know the range of variation in these forms under consideration; therefore I am placing *terrestris* as a species rather than a variety—for the present, at least.

This species is reported to be very abundant on the surface of pineapple soils under mulching paper, and to feed largely upon decomposing plant refuse. It is common also in the soil, and occurs among pineapple roots. In cane fields the species is found not only in the soil but also on the growing plant, often under leaf sheaths of sugar cane.

Honolulu, March 7, April 5, October 8, 1927; May 4, 7, 9, October 1, 4, 1928 (J. F. Illingworth and R. H. Van Zwaluwenburg); September, 1930 (F. X. Williams); Wahiawa, Oahu, July 28, December 3, 1928 (J. F. Illingworth); Pupukea, Oahu, October 1, 1928 (J. F. Illingworth).

Cotypes.—Cat. No. 43771, U. S. N. M.

Tribe PARONELLINI Börner

Genus SALINA MacGillivray

Cremastocephalus Schött (1896, p. 175) is a synonym of *Salina* MacGillivray (1894, p. 107). See Folsom, 1927, p. 10.

Salina maculata new species. (Plate 10, figs. 105-110).

Salina maculata is yellow, marked with dark purple, almost black. In lateral aspect six large spots, on abd. 2 to 4, inclusive, as shown in figure 105, are constant. Mesonotum bordered with pigment anteriorly and laterally; metanotum and often the first three abdominal terga also bordered laterally. First three antennal segments ringed apically; fourth segment purplish distally. Femur with a distal spot; tibiotarsus with a spot near the base and another beyond the middle. Furcula unpigmented. Eyes (fig. 106) eight on each side, unequal, in two parallel rows, on a common black spot. Antennae from one-fifth to four-fifths longer than the head and body, with segments variable in relative lengths, but averaging 11 : 18 : 14 : 15. Ant. 4 annulate; ant. 2 and 3 obscurely annulate. Mesonotum to fourth abdominal tergite in relative lengths as 14 : 6 : 4 : 8 : 1 : 34. Third abdominal tergite greatly reduced dorsally. Unguis (fig. 107) with two pairs of inner teeth, the distal pair weak. Unguiculus extending three-fourths as far as the unguis, with an inner angle tooth. Tenent hair strong, much longer than the unguis. Furcula almost as long as the body. Dentes longer than manubrium, often one-fifth longer. Mucro trilobed apically, as in figures 108-110. The dorsal apical bladderlike organ of the dens is somewhat obovate in lateral aspect, with usually an apical lobe, and is two-thirds as long as the mucro. Length, 1.9 mm.

This species is closely related to the Indian species *montanus* Imms (1912, p. 105) but differs from the latter in the form of the appendage of the dens, the length of the third abdominal tergite, and the presence of a tooth on the unguiculus. The color pattern of *montanus* was not described; possibly it is indefinite.

Oahu, in soil in cane fields and under leaf sheaths of sugar cane (R. H. Van Zwaluwenburg); Kauai, soil in cane fields (R. H. Van Zwaluwenburg); Kona, Hawaii, March 12, 1928, from coffee leaves (J. F. Illingworth).

Cotypes.—Cat. No. 43772, U. S. N. M.

Tribe CYPHODERINI Börner

Genus CYPHODERUS Nicolet

Cyphoderus assimilis Börner. (Plate 10, figs. 111-112).

White. Eyes absent. Antennae from one-fifth to three-fifths longer than the head, with segments about as 9 : 23 : 14 : 35, or 8 : 19 : 11 : 28.

Abd. 4 about two and one-half times as long as abd. 3. Unguis (fig. 111) almost straight, quadridentate. Of the basal wing-teeth of the unguis, the anterior is narrowly suboblong; the posterior much longer and narrowly triangular. Beyond are two strong teeth. The apex of the claw projects from a membranous tunica. Unguiculus extending three-fourths as far as the unguis, with a large acute outer lobe. Tenent hair as long as the inner border of the unguis. Dens two-thirds as long as manubrium; outer dorsal pinnae 5 to 7, all short; inner dorsal pinnae 5, there being 4 short proximal pinnae and 1 long distal pinna, which extends to the anteapical tooth of the mucro (fig. 112); the outer distal pinna is five-ninths as long as the mucro. Ventroapical scale of dens extending beyond the mucro. Mucro (fig. 112) almost half as long as dens, bidentate, with a narrow lamella extending forward from the anteapical tooth.

This form agrees essentially with the description of *C. assimilis* Börner (1906, p. 181), although the ventro-apical scale under the mucro is longer than in his description, and the posterior wing-tooth of the unguis broader than in his figure (Börner, 1913, p. 277). As in the species referred to *assimilis* by Handschin (1926, p. 460), the unguis has a peculiar apical membrane.

C. assimilis was described from specimens in Germany on orchids from the West Indies. Handschin studied material from Java. I now regard my *C. similis* (Folsom, 1927, p. 12) from Panama as synonymous with *assimilis* Börner.

Honolulu, February, 1930, with *Pheidole* ants (F. X. Williams).

Specimens.—Cat. No. 43773, U. S. N. M.

Subfamily SMINTHURIDINAE Börner

Abd. 5 and 6 ankylosed, broadly joined to abd. 4. Males with clasping antennae .... SMINTHURIDES

Genus SMINTHURIDES Börner

Sminthurides ramosus new species. (Plate 10, fig. 113; Plate 11, figs. 114-123; Plate 12, figs. 124-126).

FEMALE. Head and body mostly purple. Sternum unpigmented. Antennae dull purple to clear purple throughout. Legs pale, tinged with purple. Manubrium slightly pigmented; dentes unpigmented. Eyes at least twelve (fig. 113), possibly sixteen, on black spots. Antennae subequal to head in length, elbowed between ant. 1 and ant. 2, with segments about as 10 : 16 : 15 : 27 (fig. 114). Ant. 3 organ with a pair of suboval or subreniform lobes as in figures 115 and 116. Ant. 4 not subsegmented. Thoracic segmentation absent dorsally. Genital and anal segments ankylosed

into a single mass. Unguis (fig. 117) slender, with a long inner tooth a little beyond the middle, and a pair of small lateral teeth; the inner tooth is often weak on the hind feet. Unguiculus half as long as the inner margin of the unguis, slender, tapering, with a subapical filament longer than the unguiculus and exceeding the unguis. This filament is distinctly knobbed in some cases, and not in others. Knobbed tenent hairs absent. Tibiotarsal organ of hind legs absent. Vesicles of ventral tube smooth-walled. Dentes with strong curving simple setae dorsally and laterally; ventrally with many short, stiff, appressed setae except basally. Mucro (fig. 118) with outer margin entire, inner margin serrate, and with a baso-lateral seta. Rami of tenaculum tridentate (fig. 119); anterior lobe of corpus with two setae (sometimes three). Head and body with strong stiff spinelike setae (fig. 120). The suranal lobe of the female bears on each side a strong branched seta (fig. 120); a similar seta also occurs dorsally on each subanal lobe. In manner of branching these setae vary considerably (figs. 121, 122). Filiform bothriotricha are present. On each side of the body mass, three antero-dorsal were seen; and on each side, near the base of the ano-genital segment, two dorso-lateral. Integument minutely tuberculate. Length, 1 mm.

MALE. Body and antennae purple. Legs tinged with purple. Furcula unpigmented. Antennae (fig. 123) remarkably stout, one-third longer than the head, with segments as 10 : 9 : 4 : 8. Ant. 2 and 3 are modified to form a complex gripping apparatus of various hooks and lobes (fig. 124). (The antennae of the male grasp those of the female at copulation.) Ant. 4 elliptical, not subsegmented. Each tibiotarsus of the front legs bears basally on the outer side four sense organs (fig. 125), externally elongate, sub-oblong, thick-walled and slightly elevated. Claws and mucrones similar to those of the female, though the latter (fig. 126) are more slender than in the female. Length, 0.6 mm.

Honolulu, November, December, 1925, in soil of cane fields (R. H. Van Zwaluwenburg).

Cotypes.—Cat. No. 43774, U. S. N. M.

Subfamily SMINTHURINAE Börner

Tibiotarsi with two or three short stout appressed tenent hairs. Anal segment of male with a clasping organ of curving setae....... ...BOURLETIELLA

Genus BOURLETIELLA Banks

Bourletiella insula new species. (Plate 12, figs. 127-132).

FEMALE. Body dorsally purple with numerous pale spots; postero-laterally with an area of small rounded pale spots; sternum mostly pale. Head purple dorsally; pale orally, and sometimes laterally. Antennae purple throughout. Legs pale, tinged faintly with purple, or pale throughout. Furcula unpigmented, or manubrium with a trace of purple apically. Eyes (fig. 127) sixteen. Antennae a little longer than the head (as 8 : 7), with

segments about as 4 : 8 : 11 : 18. Ant. 4 obscurely annulated, with apparently seven subsegments (fig. 128). Ant. 3 organ (fig. 129) with a pair of contiguous ovate lobes and two guard setae. Anal appendages of female as in figure 130. Unguis (fig. 131) slender, with one inner tooth one-third from the apex (tooth sometimes absent, especially on mid and hind feet). Unguiculus narrowly lanceolate, acuminate, extending from two-thirds to three-fourths (on hind feet) as far as the opposite unguis. Knobbed tenent hairs 3, 3, 3, appressed. Vesicles of ventral tube long, cylindrical, tuberculate. Manubrium and dentes with a few simple dorsal setae; dentes with a few lateral setae also; both naked ventrally. Dens seven-eighths as long as manubrium. Mucro (fig. 132) one-third as long as dens, with both dorsal margins entire. Rami of tenaculum tridentate; ventral lobe elongate, subcylindrical, rounded apically, with four short setae apically. General clothing of short simple curving setae. Length, 1.3 mm.

MALE. Head and body pale yellowish (normally white?), with less purple pigment than in the female. The abdominal postero-lateral area of small rounded spots is extensive. Genital and anal segments purple dorsally, otherwise pale. Antennal segments about as 7 : 12 : 22 : 38. Ant. 1 and 2 pale, purple apically; ant. 3 and 4 purple throughout. Legs and furcula unpigmented. Anal segment with dorsal hooked setae modified for clasping. Length, 0.8 mm.

Honolulu, April 23, November, 1925, in cane soil (R. H. Van Zwaluwenburg).

Cotypes.—Cat. No. 43775, U. S. N. M.

Subfamily DICYRTOMINAE Börner

Ant. 3 and 4, or only ant. 3, subsegmented. Dentes with serrate setae .... PTENOTHRIX

Genus PTENOTHRIX Börner

Ptenothrix dubia new species. (Plate 12, figs. 133-136).

Variegated with olive, brown, purple and white. Body mostly brown dorsally, spotted with pure white (figs. 133, 134). On the anterior half of the dorsum (fig. 134) there is a median lanceolate translucent pale area bordered on each side with a row of chocolate-brown spots, which in turn are bordered laterally with irregular white spots. Head mostly blackish purple. Vertex with elliptical white spots between the eyes. Antennae (fig. 133) blackish with four white bands, as follows: on ant. 2, basally and apically; on ant. 3 subapically; and on ant. 4 basally. Legs (fig. 133) mostly purple beyond coxae; tibiotarsi white on distal three-fifths and sometimes at base; femora with an outer white streak. Ventral tube blackish purple. Manubrium and dentes purple throughout. Eyes sixteen. Antennal segments in relative lengths about as 5 : 21 : 24 : 7. Ant. 3 annulate on distal half, ant. 4 annulate throughout. Posterior part of abdomen with a large median-dorsal rounded tubercle (fig. 133), bearing numerous short stiff setae. Unguis (fig. 135) long and slender, with two strong inner teeth

and two pairs of small lateral teeth. Unguiculus extending half as far as the unguis, sublanceolate, with subapical filament exceeding the unguis, and with long slender inner tooth. Knobbed tenent hairs absent. Vesicles of ventral tube cylindrical, tuberculate. Manubrium naked ventrally. Dentes naked ventrally except distally; dorsally with numerous long stiff setae, the last three to five of which are basally serrate (fig. 136). Mucro (fig. 136) with both dorsal margins serrate. Clothing of short simple setae. Integument granulate. Length, 2.3 mm.

This species, with its characteristic dorsal tubercle, may be *Ptenothrix mirabilis* Denis (1929*b*, p. 319), described from China. Additional material from China is desirable, as that studied by Dr. Denis was in too poor condition to show the color pattern.

Two of Denis' specimens had the dorsal tubercle and two did not have it; though all four seemed to be the same species. Denis suggests, therefore, that the species is sexually dimorphic, and that the individuals with the tubercles are the females.

The material of *P. dubia* consists of four individuals, all of which have the dorsal tubercle.

Hering Valley, Tantalus, Honolulu, December 31, 1929, on damp boulder (F. X. Williams).

Cotypes.—Cat. No. 43776, U. S. N. M.

References

BÖRNER, C. 1901. Neue Collembolenformen und zur Nomenclatur der Collembola Lubb. Zool. Anz. 24: 696-712.

1906. Das System der Collembolen. Mitth. Naturh. Mus. Hamburg 23: 147-188.

1913*a* Neue Cyphoderinen. Zool. Anz. 41: 274-284.

1913*b*. Zur Collembolenfauna Javas. Tijds. Ent. 56; 44-61.

CARPENTER, G. H. 1904. Collembola. Fauna Hawaiiensis 3: 299-303.

DENIS, J. R. 1923. Notes sur les Aptérygotes. Ann. Soc. Ent. France 92: 209-246.

1924*a*. Sur la Faune francaise des Aptérygotes. IV. Arch. Zool. Exp. Gen. 62: 253-297.

1924*b*. Sur les Collemboles du Muséum de Paris. Ann. Soc. Ent. France 93:211-260.

1929*a*. Sur deux Collemboles de Madagascar. Bull. Museum (2) 1: 104-106.

1929*b*. Notes sur les Collemboles récoltés dans ses voyages par le Prof. F. Silvestri. Boll. Lab. Zool. Portici 22: 305-320.

1931. Contributo alla conoscenza del "Microgenton" di Costa Rica, II. Bol. Lab. Zool. Portici 25: 69-170.

FOLSOM, J. W. 1902. Papers from the Harriman Alaska Expedition, XXVII. Apterygota. Proc. Wash. Acad. Sc. 4: 87-116.

1916. North American Collembolous Insects of the Subfamilies Achorutinae, Neanurinae, and Podurinae. Proc. U. S. Nat. Mus. 50: 477-525.

1917. North American Collembolous Insects of the Subfamily Onychiurinae. Proc. U. S. Nat. Mus. 53: 637-659.

1919. Collembola of the Canadian Arctic Expedition, 1913-18. Rept. Can. Arctic Exp. 1913-18, 3 (A): 1-29.

1924. New Species of Collembola from New York State. Amer. Mus. Novitates, no. 108: 1-12.

1927. Insects of the Subclass Apterygota from Central America and the West Indies. Proc. U. S. Nat. Mus. 72 (art. 6): 1-16.

HANDSCHIN, E. 1925*a*. A l'Étude de la Faune du Maroc. Les Collemboles. Bull. Soc. Sc. Nat. 5: 160-177.

1925*b*. Beiträge zur Collembolenfauna der Sundainseln. Treubia 6: 225-270.

1926. Ost-Indische Collembolen III. Treubia 8: 446-461.

IMMS, A. D. 1912. On Some Collembola from India, Burma, and Ceylon; with a Catalogue of the Oriental Species of the Order. Proc. Zool. Soc. London: 80-125.

LINNANIEMI, W. M. 1912. Die Apterygotenfauna Finlands. II. Spezieller Teil. Acta Soc. Sci. Fennicae 40: 1-361.

MACGILLIVRAY, A. D. 1894. North American Thysanura. V. Can. Ent. 26: 105-110.

SCHÄFFER, C. 1896. Die Collembola der Umgebung von Hamburg und benachbarter Gebiete. Mitt. Naturh. Mus. Hamburg 13: 147-216.

SCHÖTT, H. 1894. Zur Systematik und Verbreitung palaearctischer Collembola. K. Svenska Vet. Akad. Handl. 25 (1893), no. 11: 1-100.

1896. North American Apterygogenea. Proc. California Acad. Sc. (2) 6: 169-196.

STACH, J. 1922. Apterygoten aus dem nordwestlichen Ungarn. Ann. Mus. Nat. Hungarici 19: 1-75.

Explanation of Plates

Plate 1

Schöttella alba

Fig. 1. Eyes and postantennal organ of right side. Fig. 2. End of right antenna, dorsal aspect. Fig. 3. Right hind foot. Fig. 4. Right dens and mucro.

Xenylla sensilis

Fig. 5. Eyes of left side. Fig. 6. Sense organ of third antennal segment of right side. Fig. 7. Apex of right antenna, dorsal aspect. Fig. 8. Right fore foot. Fig. 9. Concave aspect of unguis. Fig. 10. Anal spines. Fig. 11. Left dens and mucro. Fig. 12. Right mucro. Fig. 13. Dorsal setae of metanotum.

Plate 2

Xenylla alba

Fig. 14. Eyes of right side. Fig. 15. Sense organ of third antennal segment of right side. Fig. 16. Apex of right antenna, dorsal aspect. Fig. 17. Right hind foot. Fig. 18. Anal spine. Fig. 19. Left dens and mucro. Fig. 20. Right dens and mucro.

Stachia minuta

Fig. 21. Lateral aspect. Fig. 22. Left eye and base of antenna. Fig. 23. Left eye and postantennal organ. Fig. 24. Mandible. Fig. 25. Maxilla. Fig. 26. Dorsal aspect of anal segment.

Plate 3

Stachia minuta

Fig. 27. Suranal and subanal valves. Fig. 28. Extremity of left fore foot. Fig. 29. Furcula, dorsal aspect. Fig. 30. Furcula, left aspect.

Protanura capitata

Fig. 31. Dorsal aspect. Fig. 32. Sense organ of third antennal segment of right side. Fig. 33. Extremity of right antenna, dorsal aspect. Fig. 34. Head of right mandible. Fig. 35. Head of right maxilla. Fig. 36. Left hind foot.

Plate 4

Tullbergia silvicola

Fig. 37. Dorsal aspect. Fig. 38. Left postantennal organ with pseudocellus. Fig. 39. Sense organ of third antennal segment of right side. Fig. 40. Left hind foot. Fig. 41. Left anal spine.

Folsomides exiguus

Fig. 42. Lateral aspect. Fig. 43. Eyes and postantennal organ of left side. Fig. 44. Mandible. Fig. 45. Left hind foot. Fig. 46. Right fore foot. Fig. 47. Left aspect of manubrium and mucrodens.

Plate 5

Isotomodes denisi

Fig. 48. Lateral aspect. Fig. 49. Left postantennal organ. Fig. 50. Sense organ of third antennal segment of left side, in optical cross section. Fig. 51. Same, surface aspect. Fig. 52. Ventral aspect of extremity of left antenna. Fig. 53. Head of mandible. Fig. 54. Head of maxilla. Fig. 55. Left hind foot. Fig. 56. Left dens and mucro.

Denisia falcata

Fig. 57. Lateral aspect.

Plate 6

Denisia falcata

Fig. 58. Lateral aspect of extremity of left antenna. Fig. 59. Left hind foot. Fig. 60. Right mucro and part of dens. Fig. 61. Left mucro. Fig. 62. Clothing of abd. 2.

Proisotoma nigromaculosa

Fig. 63. Eyes, postantennal organ and base of antenna of left side. Fig. 64. Right hind foot. Fig. 65. Left mucro. Fig. 66. Left mucro.

Isotoma minor

Fig. 67. Extremity of left antenna. Fig. 68. Extremity of left antenna. Fig. 69. Left hind foot. Fig. 70. Left mucro. Fig. 71. Dorsal setae, abd. 2.

Plate 7

Entomobrya multifasciata imminuta

Fig. 72. Lateral aspect. Fig. 73. Eyes of left side. Fig. 74. Right hind foot. Fig. 75. Left mucro and end of dens.

Entomobrya lactea

Fig. 76. Eyes of left side. Fig. 77. Left hind foot. Fig. 78. Left mucro and end of dens.

Sinella höfti

Fig. 79. Right hind foot. Fig. 80. Subclavate seta of hind tibiotarsus. Fig. 81. Left mucro and end of dens.

Plate 8

Sira jacobsoni

Fig. 82. Dorsal aspect. Fig. 83. Dorsal aspect. Fig. 84. Eyes of left side. Fig. 85. Right mid foot. Fig. 86. Right mid foot. Fig 87. Left mucro and end of dens. Fig. 88. Body scale.

Lepidocyrtus cyaneus

Fig. 89. Left aspect of mesonotum. Fig. 90. Right hind foot. Fig. 91. Left mucro and end of dens.

Plate 9

Lepidocyrtus inornatus

Fig. 92. Left hind foot. Fig. 93. Left mucro and end of dens.

Lepidocyrtus immaculatus

Fig. 94. Eyes of right side. Fig. 95. Right hind foot. Fig. 96. Right mucro and end of dens.

Drepanocyrtus terrestris

Fig. 97. Lateral aspect. Fig. 98. Lateral aspect. Fig. 99. Eyes of right side. Fig. 100. Left hind foot. Fig. 101. Unguis. Fig. 102. Mucro and end of dens.

Plate 10

Drepanocyrtus terrestris

Fig. 103. Left mucro and end of dens. Fig. 104. Typical body scale.

Salina maculata

Fig. 105. Lateral aspect. Fig. 106. Eyes of right side. Fig. 107. Left mid foot. Fig. 108. Right mucro. Fig. 109. Left mucro. Fig. 110. Right mucro.

Cyphoderus assimilis

Fig. 111. Left hind foot. Fig. 112. Left mucro.

Sminthurides ramosus

Fig. 113. Eyes of left side.

Plate 11

Sminthurides ramosus

Fig. 114. Left antenna of female. Fig. 115. Sense organ of third antennal segment of left side, female. Fig. 116. Same as No. 115. Fig.

117. Right fore foot of female. Fig. 118. Left mucro of female. Fig. 119. Left aspect of tenaculum, female. Fig. 120. Left aspect of suranal and left subanal lobes of female. Fig. 121. Branched seta of left subanal lobe of female. Fig. 122. Same as No. 121. Fig. 123. Left antenna of male.

PLATE 12

Sminthurides ramosus

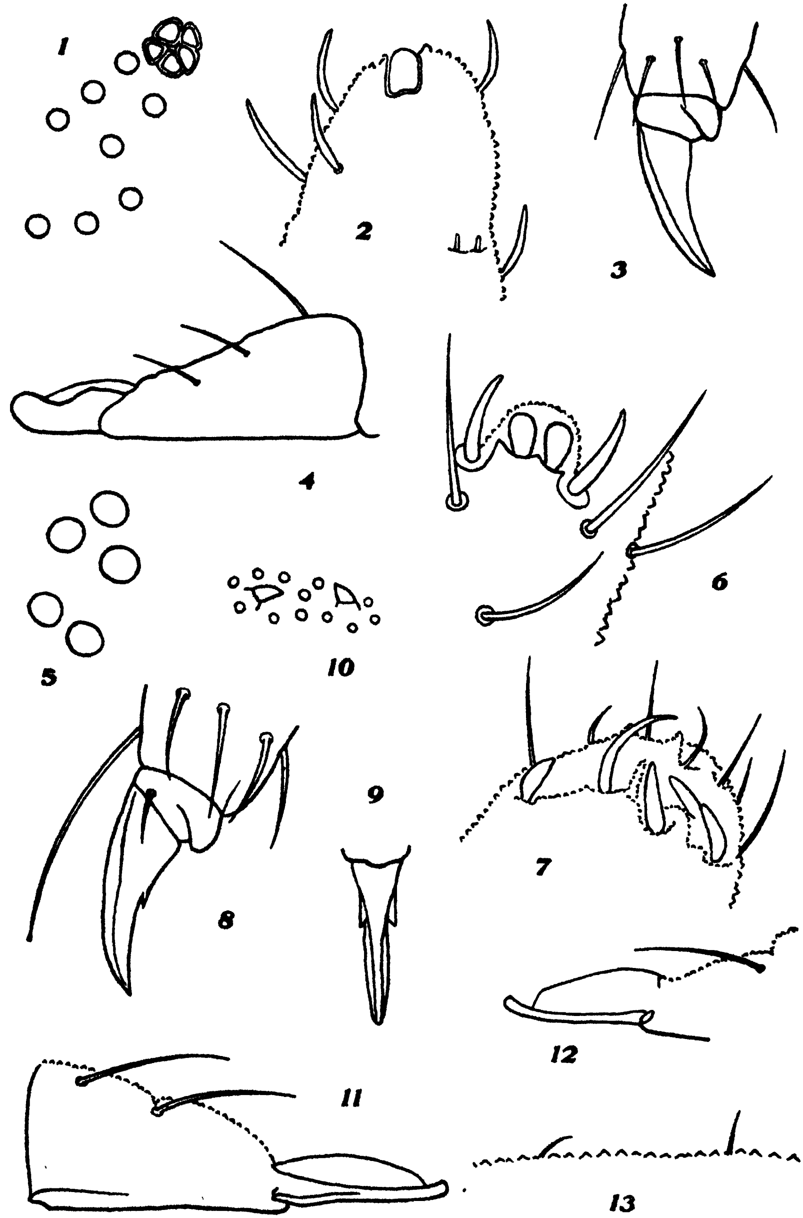
Fig. 124. Second and third segments of left antenna of male. Fig. 125. Base of front tibiotarsus of male. Fig. 126. Left mucro of male.

Bourletiella insula

Fig. 127. Eyes of left side. Fig. 128. Fourth antennal segment of female. Fig. 129. Sense organ of third antennal segment of left side. Fig. 130. Left subanal appendage of female, lateral aspect. Fig. 131. Left fore foot. Fig. 132. Left mucro.

Ptenothrix dubia

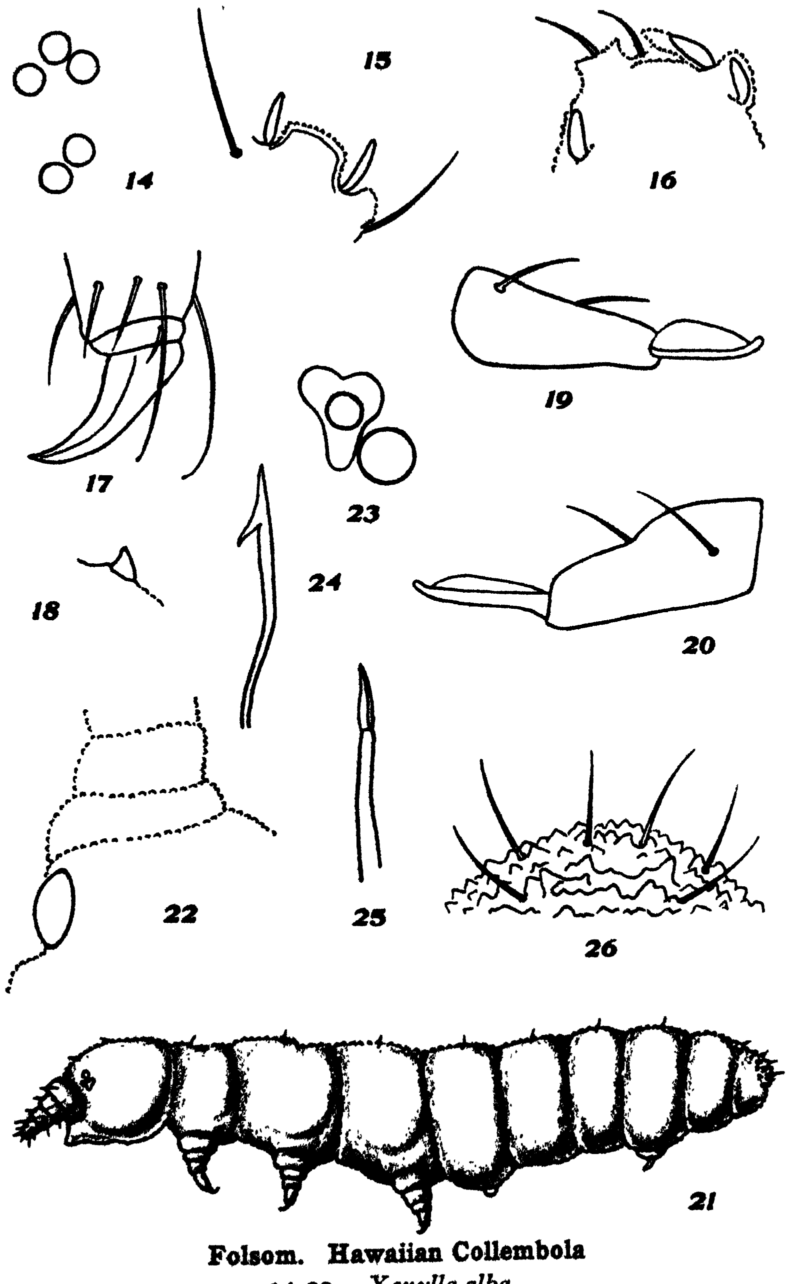
Fig. 133. Lateral aspect. Fig. 134. Dorsal aspect of body. Fig. 135. Left hind foot. Fig. 136. Left mucro.



Folsom. Hawaiian Collembola

1-4. *Schöttella alba*

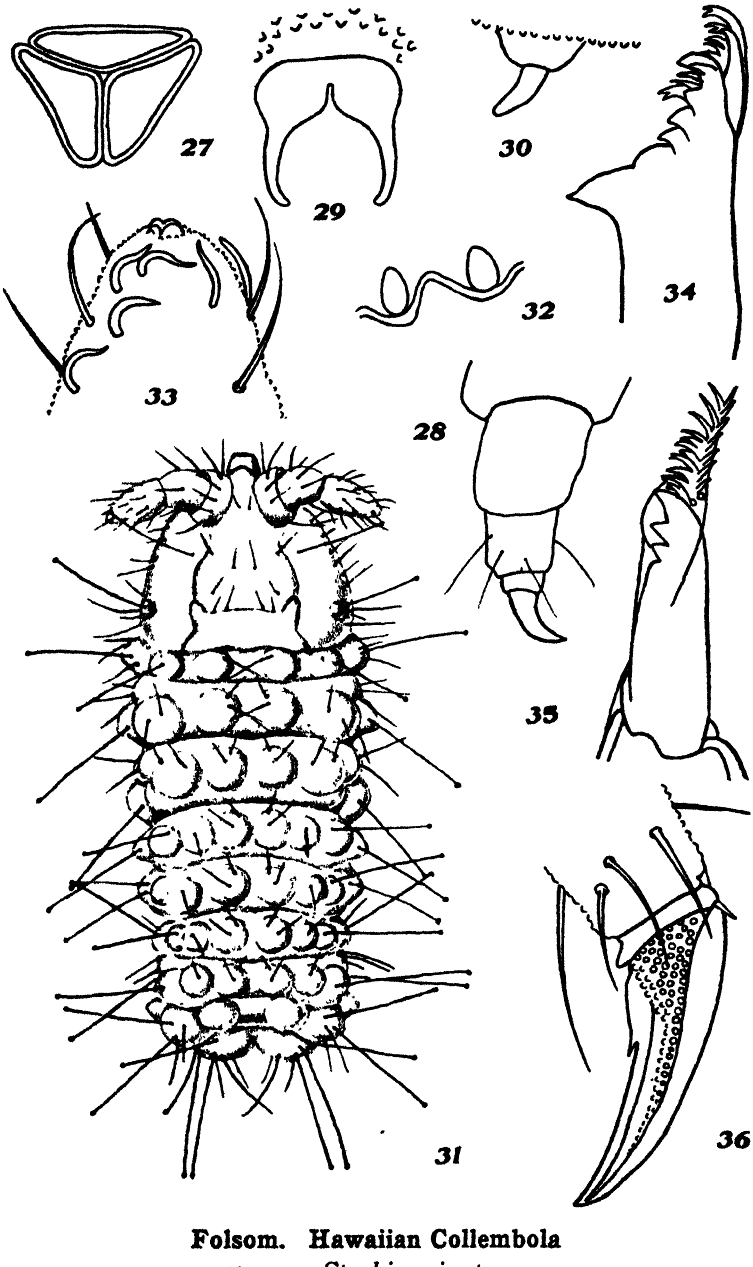
5-13. *Xenylla sensilis*



Folsom. Hawaiian Collembola

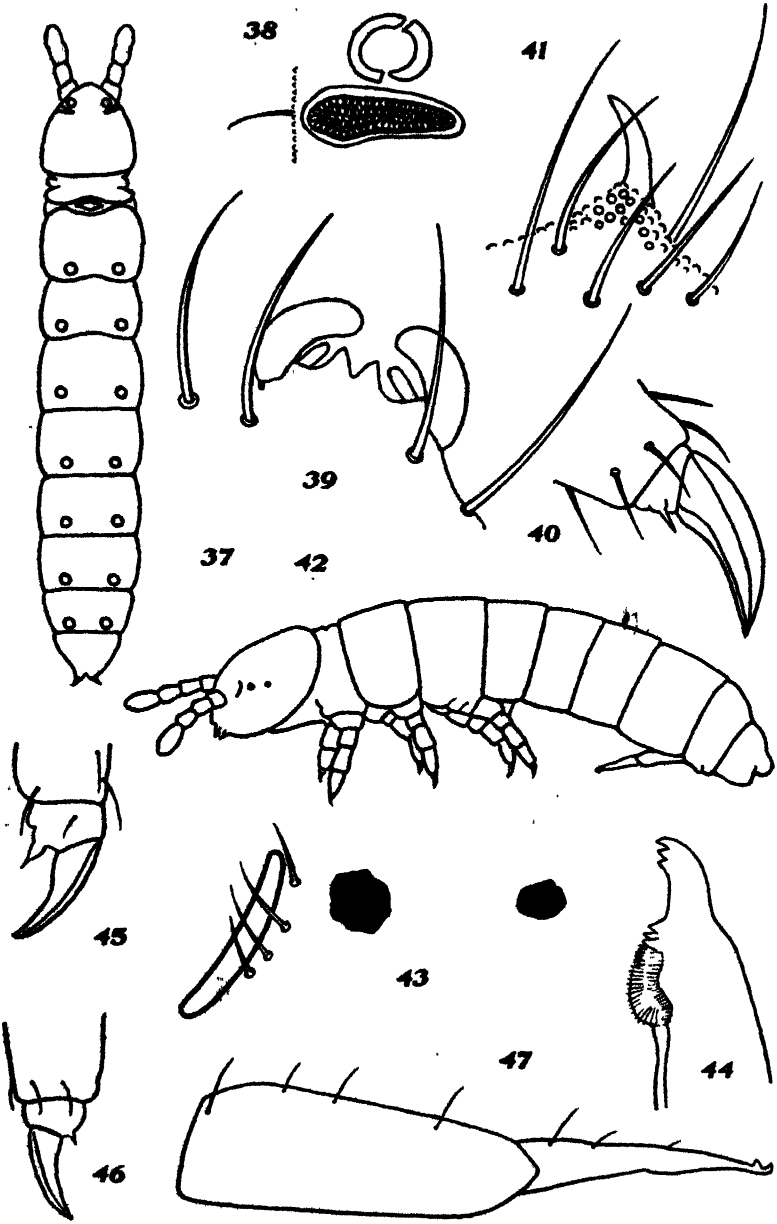
14-20. *Xenylla alba*

21-26. *Stachia minuta*



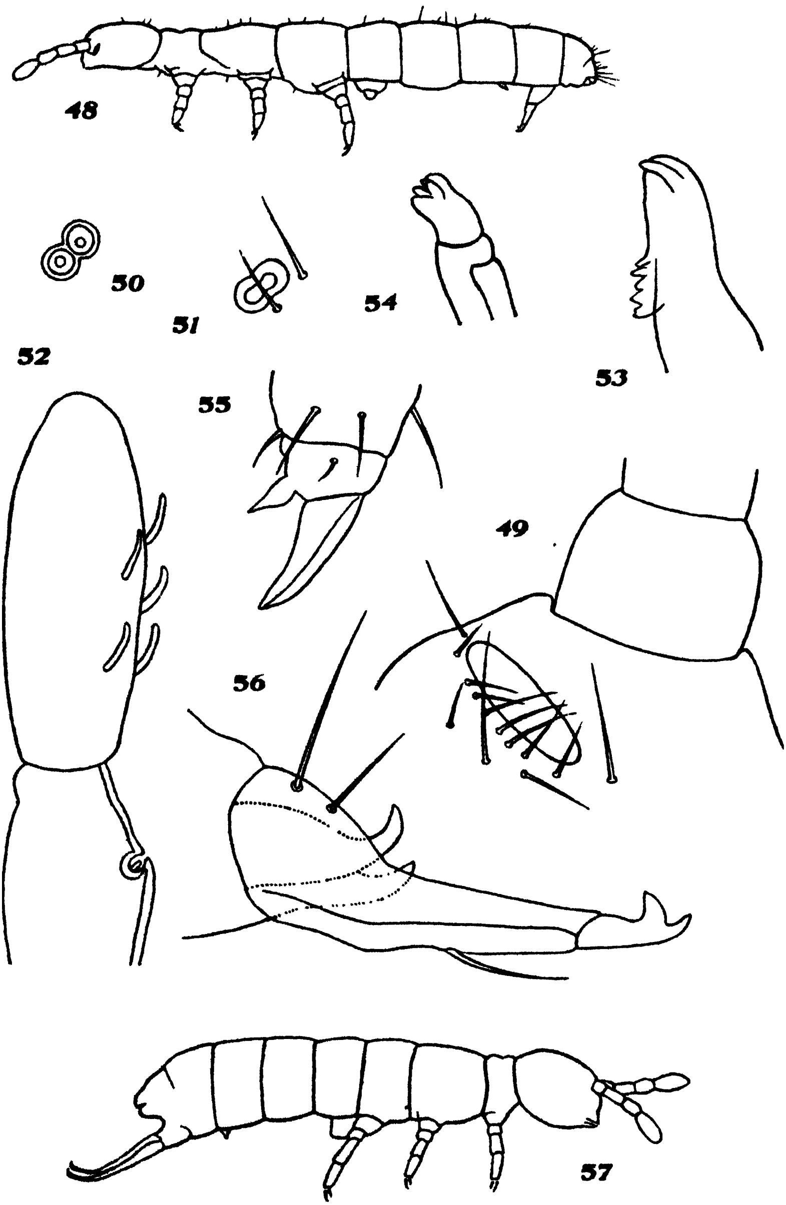
Folsom. Hawaiian Collembola

27-30. *Stachia minuta*
31-36. *Protanura capitata*



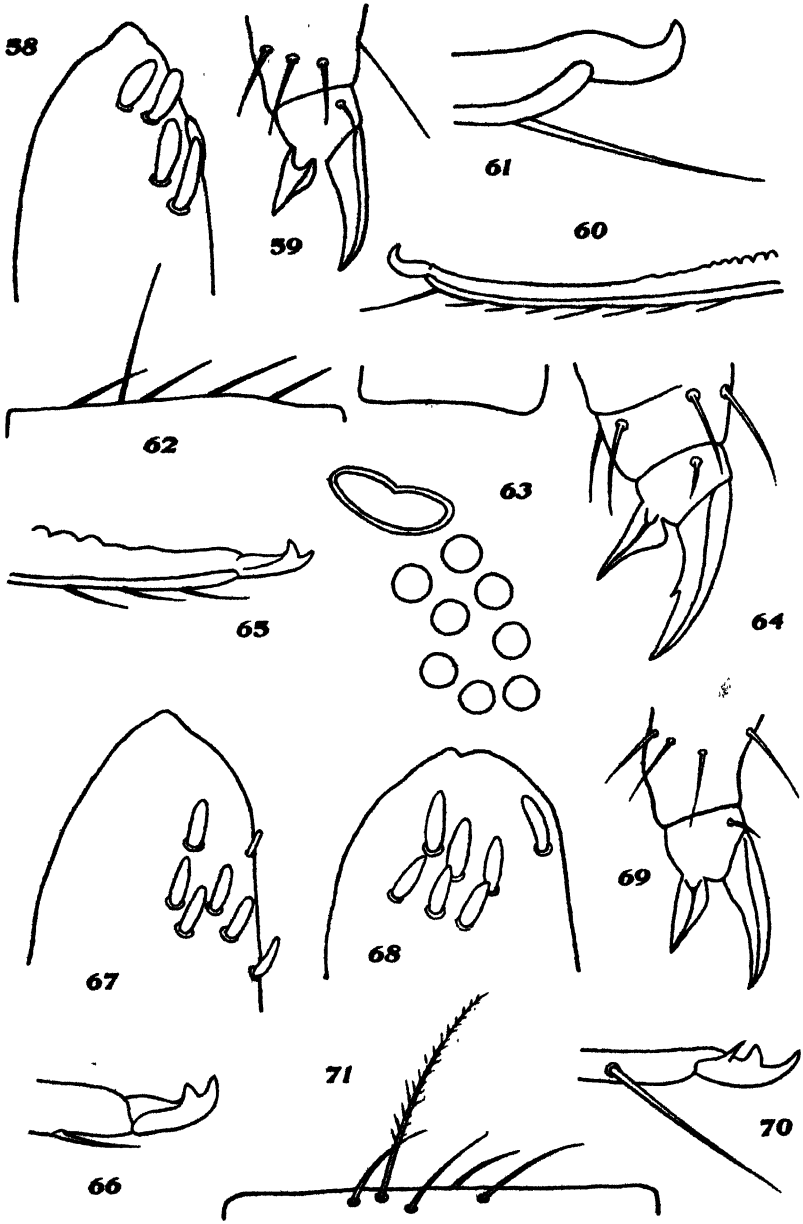
Folsom. Hawaiian Collembola

37-41. *Tullbergia silvicola*
42-47. *Folsomides exiguus*



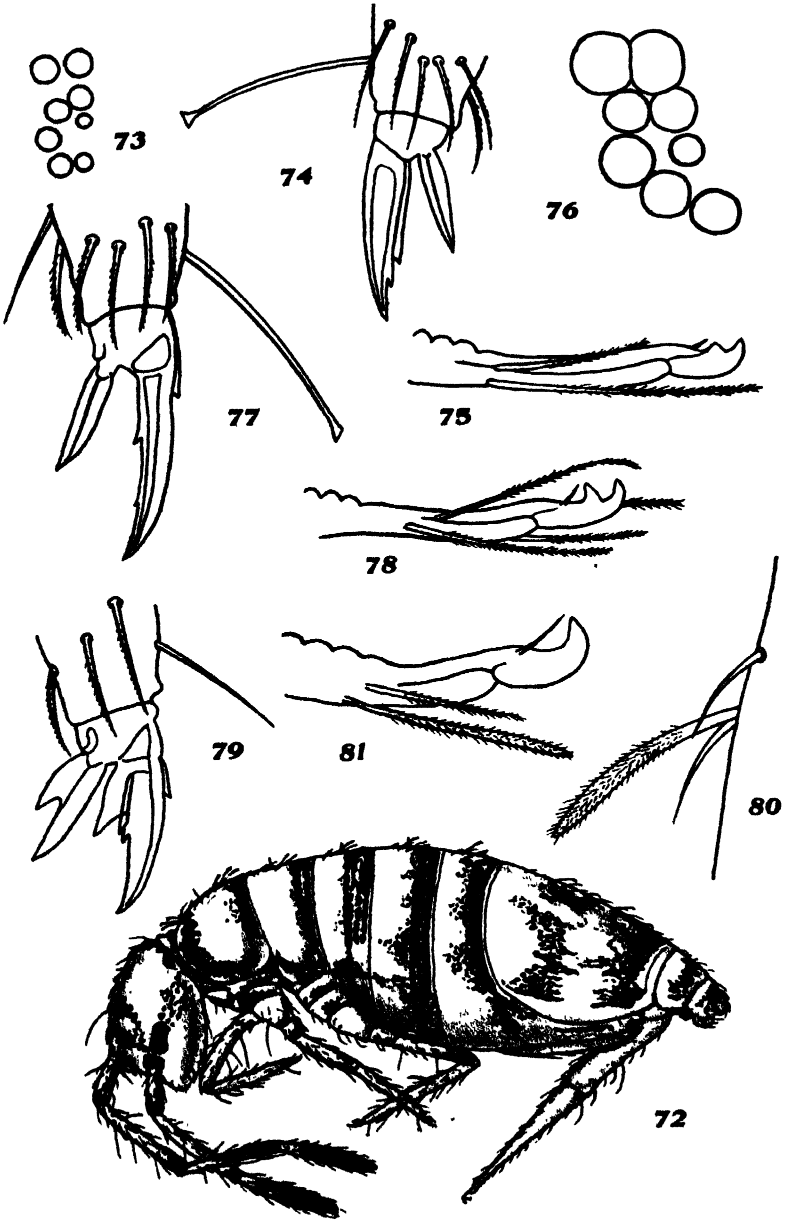
Folsom. Hawaiian Collembola

48-56. *Isotomodes denisi*
57. *Denisia falcata*



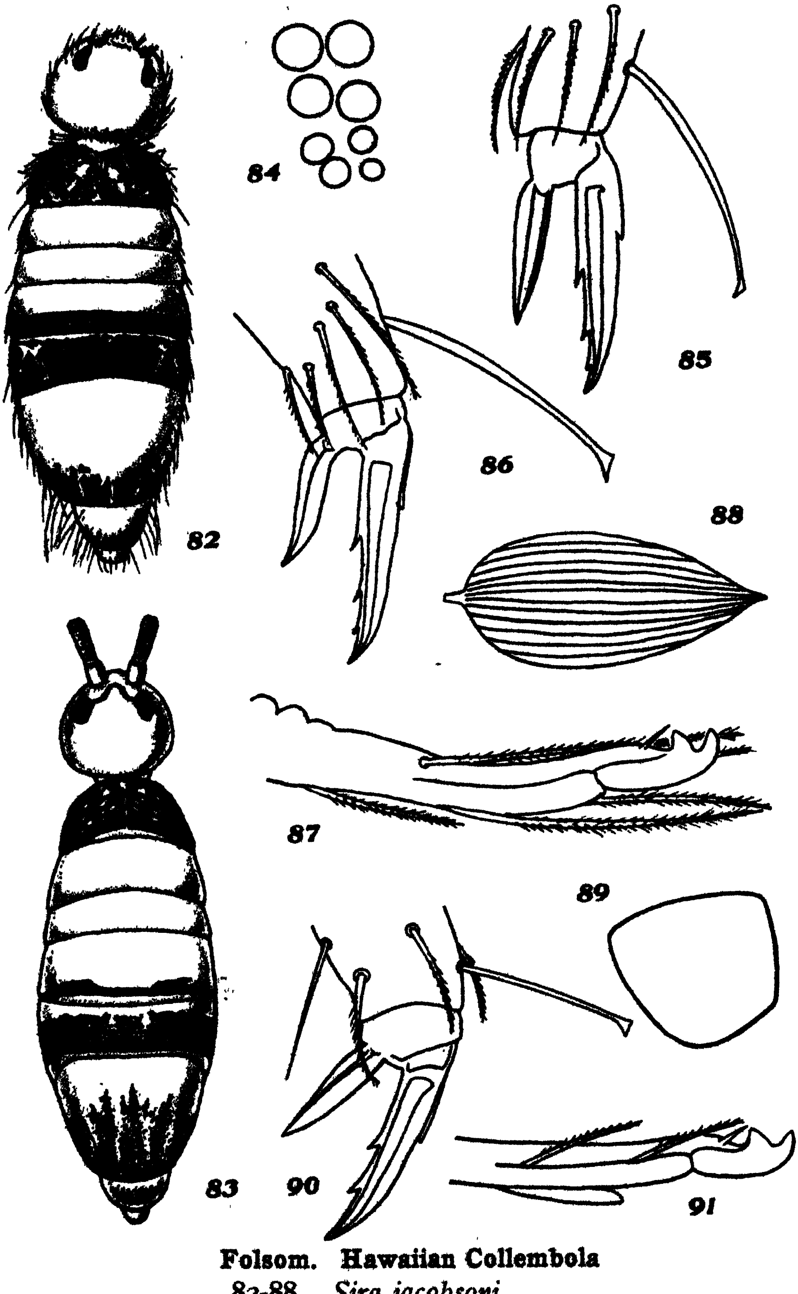
Folsom. Hawaiian Collembola

58-62. *Denisia falcata*
63-66. *Proisotoma nigromaculosa*
67-71. *Isotoma minor*



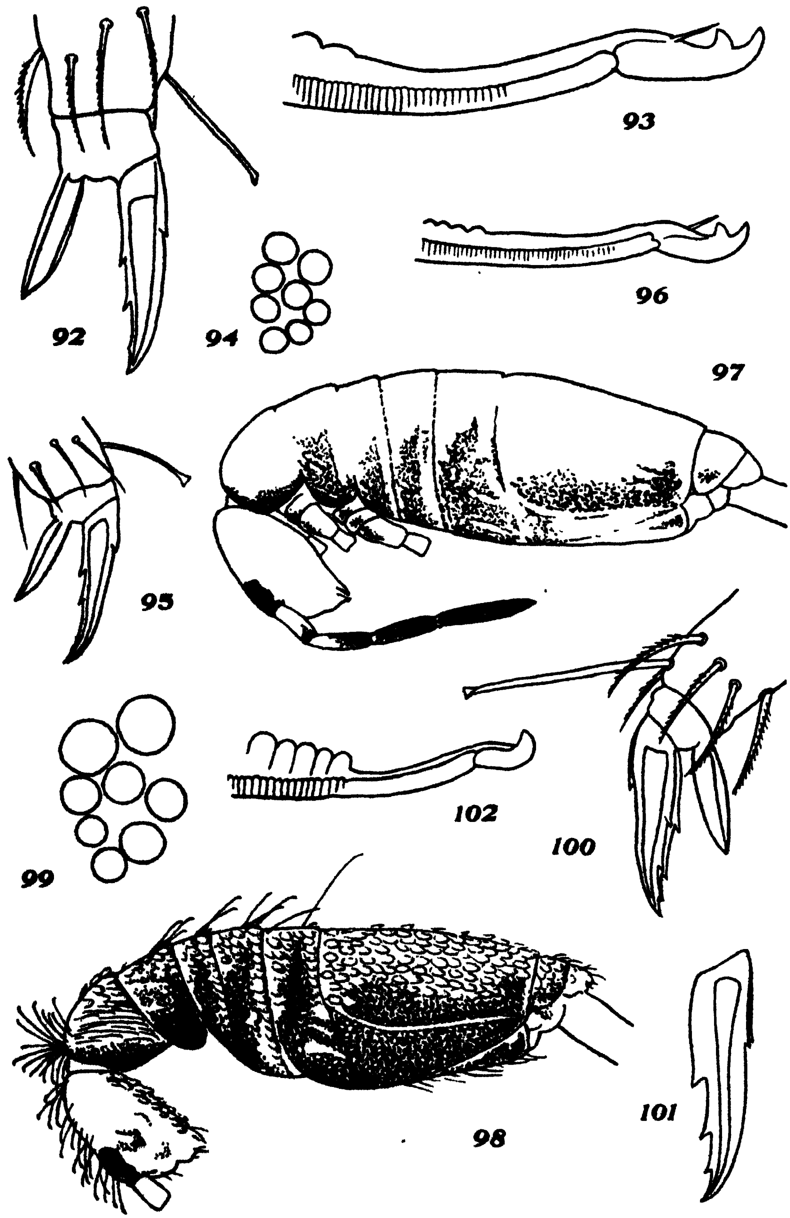
Folsom. Hawaiian Collembola

72-75. *Entomobrya multifasciata imminuta*
76-78. *Entomobrya lactea*
79-81. *Sinella höfti*



Folsom. Hawaiian Collembola

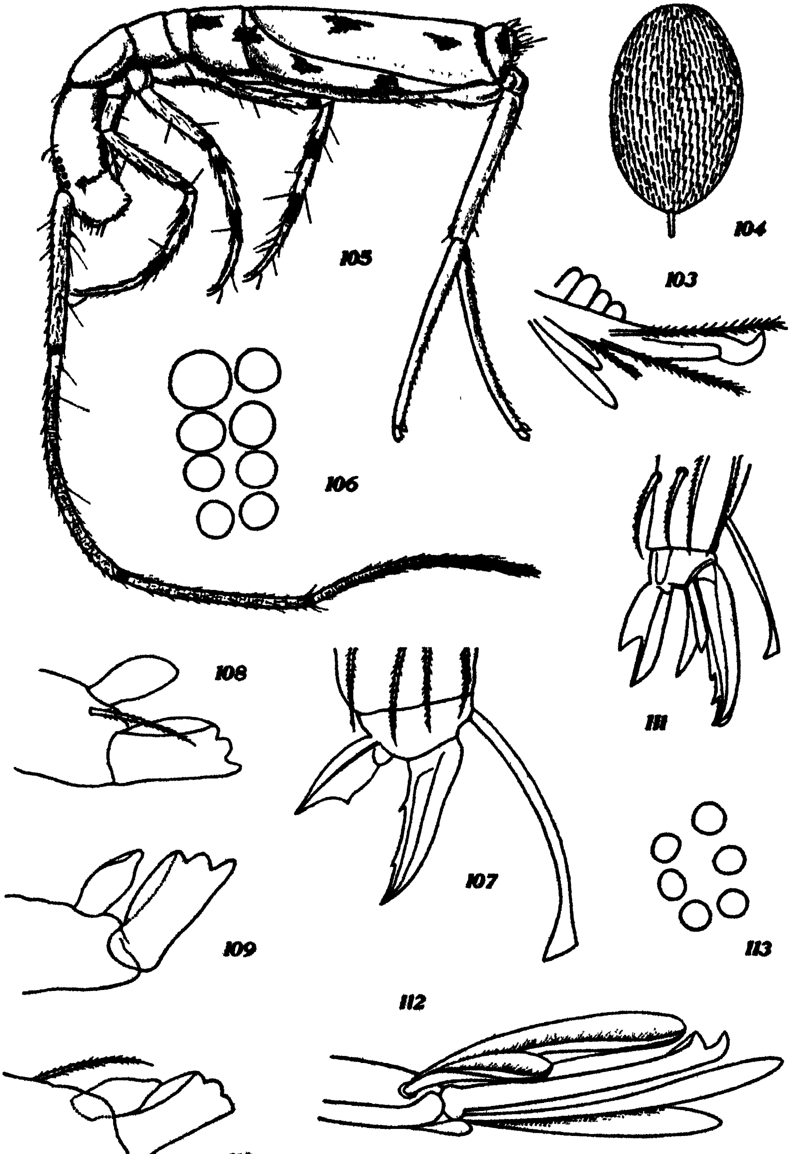
82-88. *Sira jacobsoni*
89-91. *Lepidocyrtus cyaneus*



Folsom. Hawaiian Collembola

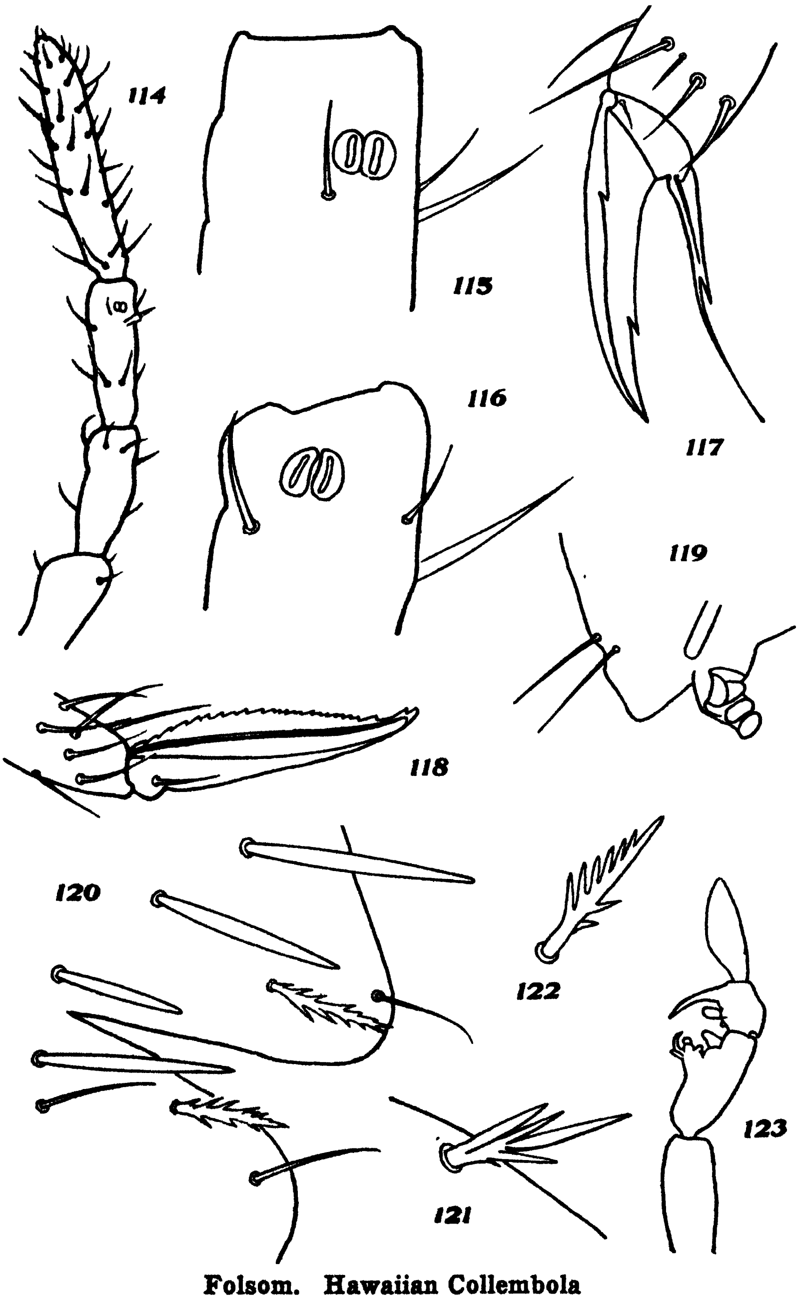
92-93. *Lepidocyrtus inornatus*
94-96. *Drepanocyrtus immaculatus*
97-102. *Drepanocyrtus terrestris*

Plate 10



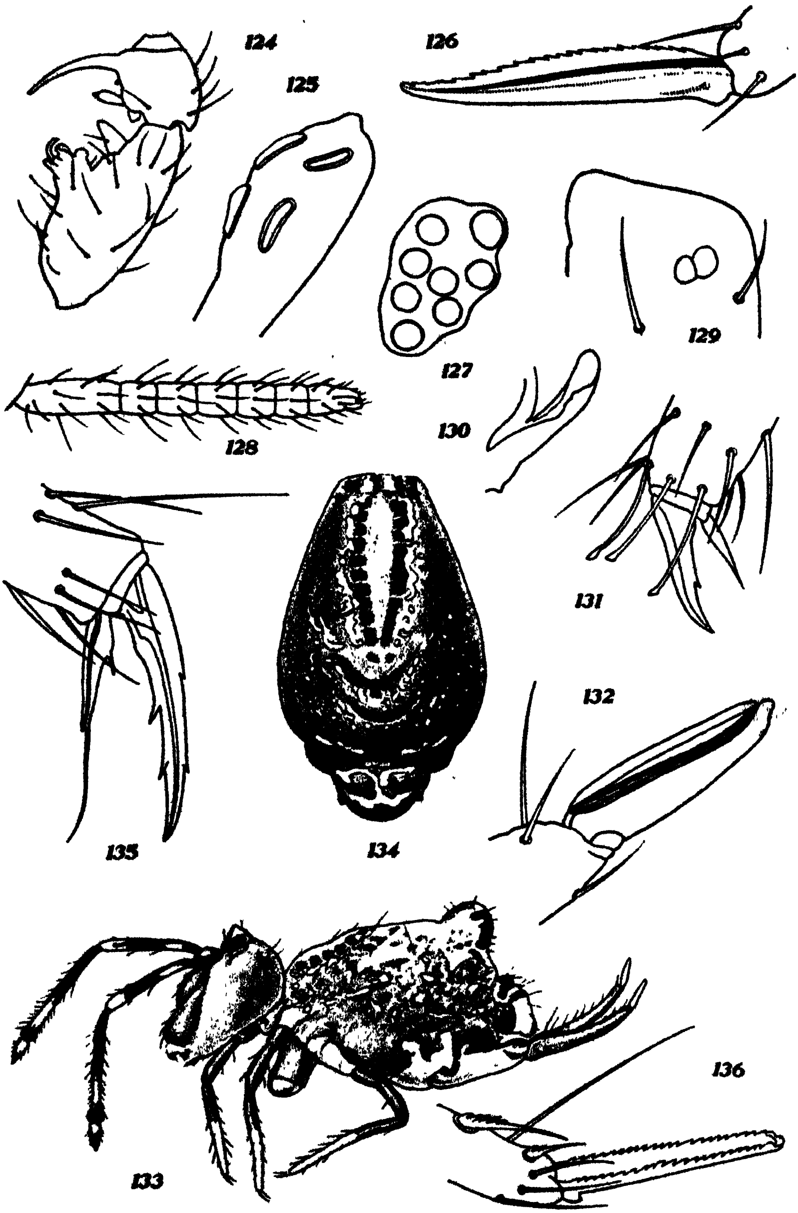
Folsom. Hawaiian Collembola

103-104. *Drepanocyrtus terrestris*
105-110. *Salina maculata*
111-112. *Cyphoderus assimilis*
113. *Sminthurides ramosus*



Folsom. Hawaiian Collembola

114-123. *Sminthurides ramosus*



Folsom. Hawaiian Collembola

124-126. *Sminthurides ramosus*
127-132. *Bourletiella insula*
133-136. *Ptenothrix dubia*

Synopsis of the Hawaiian Diaspinae (Coccidae)

BY D. T. FULLAWAY

(Presented at the meeting of April 2, 1931)

The Coccidae, on account of their economic importance, have received a large share of attention in Hawaii, but owing to the confusion which prevailed for years in the specific identification and grouping of these insects (growing out of the attempt to elucidate this large group hurriedly through work in different and widely separated countries), the earliest records of these insects here present quite a few inaccuracies in regard to species determination and are not even to be relied on as valid representations in a few cases, since some of the examples on which the records are based were evidently taken from newly imported horticultural plants. For instance, the following species listed by Kirkaldy in Fauna Hawaiiensis, Hemiptera, are not generally recognized here now, viz.: *Aspidiotus persearum*, *A. perniciosus*, *A. transparens* (*lataniae*?), *greeni*, *duplex* (*P. clavigera*?), *Diaspis patelliformis* (*S. pentagona*?), *Lepidosaphes pinnaeformis* (*L. beckii*?), *L. pomorum*, *Howardia prunicola* and *Fiorinia pellucida* (*F. fioriniae*?); nor are *Chionaspis citri* and *Aspidiotus destructor* of Kotinsky's list. On the other hand there are a few well-recognized species here that are not placed in either of these lists and one or two possibly that have never been recorded here. To the best of my knowledge the following species represent the present diaspine fauna (numerals refer to table of literature consulted, following):

Parlatoriini

Parlatoria proteus var. *crotonis* (15, 25, 32)
" *mytilaspiformis* (8)
" *zizyphus* (2, 32)

Leucaspidini

(none)

Lepidosaphini

Lepidosaphes gloveri (8, 25, 26, 32)
" *auriculata* (22, 24)
" *beckii* (8, 25, 26, 32)
" *pallida* (8, 32)
Ischnaspis longirostris (3, 32)
Lepidaspidis uniloba (27, 32)
Andaspis flava var. *hawaiiensis* (7, 30)

Diaspidini

Aulacaspis rosae (25, 32)
" *fulleri* (10, 32)
" *major* (23, 29, 31)
Diaspis boisduvali (25, 32)
" *bromeliae* (32)
" *echinocacti* (32)
Phenacaspis eugeniae var. *sandwicensis*
Pinnaspis (*Hemichionaspis*) *buxi* (15)
" *minor* (32)
" *aspidistrae* (8, 25, 32)
Howardia biclavis (8, 32)
Tsukushiaspis pseudoleucaspis (16, 32)

Fioriniini

Fiorinia fioriniae (8, 12, 32)
" *nephelii* (13, 24)

Aspidiotini

Aspidiotus lataniae (8, 11, 25)
" *rapax* (8, 25)
" *hederae* (8, 25)
" *cyanophylli* (8, 9, 25)
Chrysomphalus aonidum (9, 25)
" *dictyospermi* (4, 9, 25)
" *rossi* (8, 9)
" *aurantii* (8, 9, 25)
Odonaspis secreta (8)
" *ruthae* (21, 33)
Morganella maskelli (4)
Pseudaonidia clavigera (9)

I give below a tentative list of host-plants. This could no doubt be considerably amplified with a little intensive work on this group.

Andaspis flava var. *hawaiiensis*—bark of shade trees.
Aspidiotus cydoniae—guava, Cycas, klu
" *rapax*—citrus
" *hederae*—Platydesma
" *cyanophylli*—sugar cane, mango, wistaria, avocado, Eugenia
Aulacaspis rosae—rose
" *fulleri*—Aglaia
" *major*—litchi, longan
Chrysomphalus aonidum—Cycas, citrus, coconut
" *dictyospermi*—palms, ferns, Verschaffeltia
" *rossi*—Araucaria
" *aurantii*—Cycas, citrus
Diaspis boisduvali—orchids
" *bromeliae*—pineapple
" *echinocacti*—Cereus
Fiorinia fioriniae—avocado
" *nephelii*—litchi

Howardia biclavis—papaya, Plumeria, Nephelium, hibiscus, Ficus, Cassia
Ischnaspis longirostris—palm
Lepidaspidis uniloba—maile
Lepidosaphes gloveri—citrus, croton
" *auriculata*—croton
" *beckii*—citrus, coconut
" *pallida*—juniper
Morganella maskelli—fig
Odonaspis secreta—bamboo
" *ruthae*—manienie
Parlatoria proteus var. *crotonis*—croton
" *mytilaspiformis*—orchids, croton
" *zizyphus*—citrus
Phenacaspis eugeniae var. *sandwicensis*—oleander, mango, coconut, kukui
Pinnaspis (*Hemichionaspis*) *buxi*—Philodendron, lauhala
" *minor*—hibiscus, avocado, geranium, yams, ferns
" *aspidistrae*—ferns
Pseudaonidia clavigera—grape, loquat, tamarind pods
Tsukushiaspis pseudoleucaspis—bamboo

Field Key to Species

1. Diaspines that are specific in their host relationship 2
   Diaspines that are not specific in their host relationship 10
2. Female scale short oval to rectangular in outline (on croton) .... *Parlatoria proteus* var. *crotonis*
   Not so 3
3. Female scale longitudinal, i.e., elongate, sometimes narrow in front, more or less broadened behind 4
   Female scale circular 6
4. Female scale six times as long as wide (on bamboo) .... *Tsukushiaspis pseudoleucaspis*
   Female scale not more than three times as long as wide 5
5. Female scale with only one exuvia at anterior end; orange yellow, exuvia dark brown (on litchi) .... *Fiorinia nephelii*
   Female scale with two exuviae at anterior end, entirely white, semi-diaphanous, exuviae pale stramineous (on croton) .... *Lepidosaphes auriculata*
6. Female scale with exuviae in center 7
   Female scale with exuviae marginal 9
7. Female scale dark colored (reddish brown), exuviae blackish (on Araucaria) .... *Chrysomphalus rossi*
   Female scale light colored (chalky white), exuviae straw yellow 8
8. Bamboo-inhabiting species .... *Odonaspis secreta*
   Bermuda-grass-inhabiting species .... *Odonaspis ruthae*
9. Rose-inhabiting species .... *Aulacaspis rosae*
   Litchi and longan-inhabiting species .... *Aulacaspis major*
   Aglaia-inhabiting species .... *Aulacaspis fulleri*
   Cactus-inhabiting species .... *Diaspis echinocacti*
   Pineapple-inhabiting species .... *Diaspis bromeliae*
   Orchid-inhabiting species .... *Diaspis boisduvali*

10. Scales found principally on or under bark 11
Scales found principally on leaf or stem 13
11. Female scale light colored (under bark), greyish stained with yellow, which is the color of the first exuvia; second dull crimson, secretionary covering opaque white; scales circular, exuviae central .... *Howardia biclavis*
Female scale dark colored 12
12. Female scale circular, 2.5 mm. diameter, moderately convex, blackish, entirely covered by the epidermis of the twig except the small shining sublateral orange-ferruginous exuviae .... *Pseudaonidia clavigera*
Female scale circular to broad oval, 1 mm. diameter, tolerably convex, pitch black; exuviae concolorous, very inconspicuous; placed toward the side .... *Morganella maskelli*
Female scale mytiliform, thin, flat and more or less transparent, 1.5 mm. long, color varying from pale brown to dark brown, exuviae terminal, rather dull copper colored and about one-fourth length of scale .... *Lepidosaphes hawaiiensis*
13. Female scale short oval to rectangular in outline, black .... *Parlatoria zizyphi*
Not so 14
14. Female scale longitudinal 15
Not so, circular, with exuviae in center 24
15. Female scale filiform, six times as long as wide, black .... *Ischnaspis longirostris*
Female scale mytiliform 16
16. Female scale with only one exuvia (the first) at basal extremity; small, brownish in color (common on avocado) .... *Fiorinia fioriniae*
Not so; female scale with two exuviae at cephalic end 17
17. Female scale not expanded or broadened much caudally 18
Female scale narrow in front, broadened behind 19
18. Female scale 2.5 mm. long, .5 mm. wide, very dark reddish brown, almost black, exuviae pale straw color, 2nd exuvia ⅝ mm. long, less than half as wide, secretionary portion of scale extending along sides half its length, 1st exuvia .25 mm. long, overlapping second very little (on maile) .... *Lepidaspidis uniloba*
Female scale 1.5-2 mm. long, .5-1 mm. wide, brownish fulvous, semitransparent, paler at margin, exuviae clear yellow, occupying less than half total length of scale (on orchids, crotons) .... *Parlatoria mytilaspiformis*
19. Female scale white, pyriform, exuviae pale fulvous .... *Phenacaspis eugeniae* var. *sandwicensis*
Female scale brown 20
20. Female scale small, 2nd larval exuvia large, one-third length of scale .... *Pinnaspis buxi*
Not so, female scale normal 21
21. Medium brown to dusky, caudal margin pallid .... *Lepidosaphes pallida*
Caudal margin not pallid 22
22. Male scales white and tricarinate, wax felted .... *Pinnaspis minor* and *P. aspidistrae*
Male scales concolorous and without carinae 23

23. Female scale long and narrow, more than three times as long as wide... .... *Lepidosaphes gloveri*
Female scale shorter and wider, less than three times as long as wide .... *Lepidosaphes beckii*
24. Female scale dark colored..25
Female scale light colored..26
25. Female scale black with red nipple.................... *Chrysomphalus aonidum*
Female scale without red nipple but with white dot in center .... *Chrysomphalus dictyospermi*
26. Female scale transparent, colorless, exuviae bright yellow .... *Aspidiotus cyanophylli*
Female scale pale yellowish gray, exuviae reddish, small spot and ring of white on nipple.................................... *Chrysomphalus aurantii*
Female scale white or pale ochreous, exuviae brownish yellow or straw colored .... *Aspidiotus lataniae*
Female scale grey ochreous, exuviae castaneous brown, white ring on nipple .... *Aspidiotus rapax*
Female scale dull ochreous, exuviae yellow.................... *Aspidiotus hederae*

Key to Genera of Diaspinae in Hawaii

The following key to the genera is largely based on morphological characters which can only be made out in carefully prepared specimens with the aid of the compound microscope.

1. Caudal margin of adult female with a single, entire median lobe (median lobe undivided) 2
Caudal margin with median lobes at least (median lobes divided)..... 3
2. Scale and insect elongate.. *Lepidaspidis*
Not so, scale and insect round or oval .... *Odonaspis*
3. Median lobes of caudal margin divergent and serrate on inner edge ... 4
Not so, median lobes parallel and without serrations on inner edge... 7
4. Adult female small, inclosed in the second exuvia, only one exuvia, that of the first larva, at basal extremity of scale, second present, however, but inclosing like a puparium the very much reduced adult female insect as stated.. *Fiorinia*
Not so; more than one exuvia at narrow end of female scale 5
5. Exuviae marginal, outline of scale subcircular, pyriform or elongate.... .... *Phenacaspis*
Exuviae within the margin of scale, which is circular 6
6. Dorsal tubular gland openings scattered, not arranged in distinct rows; median lobes rather widely separated.................................... *Diaspis*
Dorsal tubular gland openings arranged in distinct rows, inner margin of median lobes close together at base.................................. *Aulacaspis*
7. Female with slender, elongate, chitinous processes extending inward from base of lobes.. *Chrysomphalus*
Chitinous processes short or absent, or if longer, clubbed................ 8

8. With branched plates (bracteae) on some of the segments anterior to the pygidium, two rows of isolated pores near caudal margin of female .... *Parlatoria*
   Without branched plates (bracteae) on segments anterior to the pygidium 9
9. Female scale circular or nearly so 10
   Female scale always elongate 13
10. Female scale with exuviae overlapping and placed at or close to anterior extremity, a conspicuous pair of stout, club-shaped paraphyses; lateres crowded with branched and spinous plates .... *Howardia*
    Female scale with exuviae completely superposed and more or less centrally situated (in male as well) 11
11. Female with an extensive reticulated tract on the dorsal surface of the pygidium .... *Pseudaonidia*
    Female without reticulated tract on dorsal surface of pygidium 12
12. Pygidium of adult female without genacerores .... *Morganella*
    Pygidium of adult female with genacerores .... *Aspidiotus*
13. Scale of female about 8 times longer than broad, sides nearly parallel..14
    Scale of female less than 8 times longer than broad, narrow at the anterior end, broadening posteriorly 15
14. Pygidium of female with reticulations on dorsal surface .... *Ischnaspis*
    Pygidium of female without reticulations on dorsal surface .... *Tsukushiaspis*
15. Male scale with a thinner transverse band on cauda providing a hinge for the lifting of caudal end; median lobes of pygidium of female separated, usually with spines between 16
    Male scale not provided with a hinge, median lobes usually close together .... *Pinnaspis*
16. Pygidium of adult female with paraphyses .... *Andaspis*
    Pygidium of adult female without paraphyses .... *Lepidosaphes*

The tribal affiliation of cited species is indicated in the species list which precedes. For a table of tribal distinctions, one is referred to MacGillivray's excellent manual. Consideration of the genera is next in order and for economy of space only a short generic characterization is made. Where reference can be given to an adequate description in coccid literature locally available the species are not described at length. In a few cases, however, it is necessary to do this and to add to completeness of treatment tables and figures are duly supplied.

Genus PARLATORIA Targ.

Targ., Cat., p. 42 (1869).

This genus includes species of the Diaspinae having the scale of the adult female circular to oval in form, whitish to gray or black in color; exuviae marginal; body of the adult female ap-

proximately oval; pygidium with three pairs of well-developed lobes, the fourth somewhat developed and all more or less distinctly notched, at least on the outer side; a fringe of finely toothed plates between the lobes, and a series of thick-walled, broad-mouthed marginal glands placed parallel to the body margin; scale of the male oblong, non-carinated and rather narrow, with the exuvia placed at the anterior extremity.

So far as the author can ascertain we have but 3 species of this genus in Hawaii. They may be distinguished by the following key:

1. Scale of adult female with second exuvia of medium size, never covering one half of scale 2
   Scale of adult female with second exuvia large, covering two-thirds or more of scale, black; pygidium of adult female with lobes distant, median, second and third pairs bluntly rounded, entire; distapectinae broad, not truncate, approaching latapectinae in form; anus and vulva located near line drawn between pregenacerores and postgenacerores, altaceratubae about 17, one mesal and 8 on each side; genacerores (6-7), 7-10........ *zizyphi*
2. Scale of female circular or oval, never twice as long as wide, orange yellow, sometimes tinged with green; exuviae yellowish, darker than excretionary portion; lobes comparatively narrow, subconical, bluntly pointed, with more or less distinct mesal and lateral notches; pectinae broad and deeply toothed; altaceratubae 19, one mesal and 9 on each side; anus located midway between vulva and caudal margin; spiracerores wanting; genacerores (5-7); 4-7..... *proteus* var. *crotonis*
   Scale of adult female elongate with subparallel sides, more than twice as long as wide, brownish fulvous, exuviae yellow; lobes comparatively narrow, distant, end bluntly pointed with mesal, and lateral notches; fourth pair of lobes sometimes represented by rudiment; pectinae of median, second and third incisurae narrow, others wide; spiracerores wanting; genacerores (6-6) 5-5; brevaceratubae numerous; altaceratubae distinct one mesal and nine on each side; anus located midway between vulva and caudal margin .... *mytilaspiformis*

Genus LEPIDOSAPHES Shimer

Tr. Am. Ent. Soc. I, p. 373 (1868).

This genus includes species of Diaspinae in which the scale of the adult female is elongate, narrowed in front and gradually broadening behind, more or less curved, variable in color but generally orange brown to dark brown, exuviae terminal, second one covered. Male scale similar to that of female, but much smaller and narrower, exuviae terminal. The posterior part of the scale is separated by a thin transverse band of secretion

which functions as a hinge, permitting the extremity of the scale to be raised so that the adult can emerge.

Body of adult female elongate also, margins of some of the segments often produced. Circumgenital gland orifices in five groups. A pair of median lobes well developed; second pair cleft to form two lobules, of which the inner is larger. No incisions or chitinous thickenings present. Gland spines are usually arranged as follows on either side median line: 2 between median lobes, 2, 2, 2 and 2. Anal opening small, relatively close to base of pygidium. Marginal gland orifices prominent, usually arranged as follows on either side median line: 1, 2, 2, and 1. Dorsal gland orifices present, arranged in 2-3 rows. Ventral thickenings distinct.

Type *L. ulmi* (Linn.).

Three species belonging to this genus are found in Hawaii, which may be differentiated with the following key:

1. An ear-like lateral lobe on either side at base of cephalic area; pygidium without plates in second incision .... *auriculata*
   No ear-like lateral lobe present; pygidium with plates in second incision 2
2. Margin of penultimate and two preceding segments of body with chitinous spur; genacerores 4, 6, 4.. *gloveri*
   Margin of penultimate and two preceding segments of body without chitinous spur 3
3. Mesogenacerores never less than 5.. *beckii*
   Mesogenacerores never more than 4.. *pallida*

Genus Ischnaspis Douglas

Ent. Mo. Mag. XXIV, p. 21 (1887).

This monotypical genus of the Diaspinae is distinguished by the following characteristics: The scale of the adult female is extremely long and narrow, with the first exuvia extending beyond the anterior margin; black in color and shiny. The body of the adult female is very long and narrow, the posterior margin of the pygidium forming a regular shallow concave depression from which the median lobes project. The dorsal surface of the pygidium has a peculiar latticework design. Circumgenital glands in five small groups, sometimes, however, difficult to make out in their entirety. The male scale is elongate, similar to that of the second-stage female, and without the central hinge.

Type *I. longirostris* (Sign.).

I. longirostris is a fairly common species in Hawaii on palms.

Genus Lepidaspidis MacGill.

Coccidae, MacGillivray, p. 292 (1921).

This genus is distinguished from Lepidosaphes by the fused condition of median lobes and absence of secondary ones. The genus is monotypic.

Single large mesal lobe crenulate; four distant plates on each side, cephalic two much larger than caudal two; genacerores present; caudal segments of preabdomen with two large plates; segments not deeply constricted.

Type not designated.

Only one species, viz. *L. uniloba* (Kuw.).

Genus Andaspis MacGill.

Coccidae, MacGillivray, p. 292 (1921).

This genus is distinguished from Lepidosaphes by the presence of paraphyses in the adult female and the absence of secondary lobes. The lobes are triangular, lateral margin long, minutely serrate, mesal notch small. Plates longer than the lobes, arranged 2, 1-2-2-1. Margin with six altaceratubae arranged 1, 2, 2, 1. Dorsal oraceratubae small, in two rows. Genacerores present.

Type not designated.

Only one species found in Hawaii, viz. *A. hawaiiesis* (Mask.).

Note: *Andaspis* (*Lepidosaphes*) *hawaiiensis* is not common in Hawaii—at least it has not been found in general collecting; yet in Florida this scale is common enough to be feared as a serious pest.

Genus Aulacaspis Cockerell

Journ. Inst. Jam. I, p. 180 (1893).

This genus includes species of Diaspinae in which the scale of the adult female is circular to oval, white, exuviae subcentral to submarginal. Scale of male small, elongate, parallel-sided, white, felted (wax), dorsal surface tricarinate or unicarinate. Body of the female elongate ovate, tapering posteriorly or (in aberrant species) subcircular; pallid with pygidium reddish brown, cephalothorax one-third to one-half the body; abdomen distinctly segmented.

Type *A. rosae* (Bouché).

There are three species belonging in this genus found in Hawaii, which may be differentiated by the use of the following key:

1. Adult female circular, lateral lobes undeveloped, circumgenital pores very numerous, each group 50 or more (on litchi)..*major*
   Adult female elongate, lateral lobes developed, circumgenital pores less numerous, all groups considerably less than 50.. 2
2. Inner margin of median lobes almost entire, six to seven gland spines on pygidial margin near penultimate segment (on Aglaia)..................*fulleri*
   Inner margin of median lobes distinctly serrate, usually four gland spines on pygidial margin near penultimate segment (on rose)..................*rosae*

Genus DIASPIS Costa

Prospetto nuova Div. Met. Coccus p. 7 (1828).

This genus includes species of Diaspinae in which the scale of the adult female is circular or subcircular, exuviae situated well within the margin. The first exuvia is naked or with an almost imperceptible secretionary covering, the second exuvia occupies about one-fourth the diameter of the scale and is covered by a layer of secretion. The scale of the male is small, elongate, approximately parallel-sided, white, felted (wax), tricarinate, the exuvia at the cephalic end. Body of female oval or nearly so, yellowish tinged reddish or brownish, cephalothorax pronounced, rounded (bearing in *D. boisduvali* a prominent tubercle), segmentation of the abdomen rather indistinct. Pygidium with three pairs of well-developed lobes, the fourth obscurely developed; median lobes widely separated, deeply sunken into apex of pygidium, which really forms a concavity. Circumgenital gland orifices present fairly numerous, arranged in five groups. Marginal gland orifices present, arranged as follows on either side of the median line: 1 between median lobes, then 1, 2, 2, 1.

Type *D. calyptroides*=*echinocacti*.

Three species belonging to this genus are found in Hawaii, which may be differentiated with the following key:

1. Thoracic segment with a large projecting tubercle..............................*boisduvali*
   Not so 2
2. Inner margin of median lobes free and serrate; dorsal gland orifices large ....*bromeliae*
   Both margins of median lobes free and non-serrate; dorsal gland orifices small and numerous..*echinocacti*

Genus PHENACASPIS Cooley & Cockerell

Check List Coccidae, Suppl., p. 398 (1899).

This genus includes species of the Diaspinae in which the scale of the female resembles that found in the genus Chionaspis, that is to say, it is elongate, narrow in front, more or less broadened behind, white, exuviae terminal at the cephalic end. The scale of the male is much smaller than that of the female, elongated, parallel-sided, exuvia at anterior end, unicarinate or tricarinate. The pygidium of the female is also like that of Chionaspis except that the median lobes are well separated, more or less sunken into the apical margin of the pygidium and have their inner margins serrate or crenate and strongly divergent, leaving a distinct notch in the median line.

Type *P. nyssae* (Comst.).

There is but one species of this genus found in Hawaii, viz., *Phenacaspis eugeniae* var. *sandwicensis*. The variety is here described as new.

Phenacaspis eugeniae (Maskell) var. **sandwicensis** nov.

Scale of female pyriform, only slightly convex and indistinctly carinate; length 2.5 mm., greatest width 1.5 mm.; white, surface smooth, somewhat glabrous and showing only transverse lines of growth; exuviae at anterior, narrow end pale fulvous in color; second exuviae .75 mm. long, twice length of first and overlapping first half its length.

Scale of male elongate, sides parallel, tricarinate; white, (wax) felted, 1 mm. long, exuvia at anterior end pale fulvous, about .3 mm. long.

Body of female elongate ovate, 2 mm. long, less than 1 mm. wide, pale yellow, pygidium with brownish tinge posteriorly, antennae with basal knob cuspid internally, a long curved seta extending therefrom, dorsum posterior to a transverse line through apex of rostrum marked by two submedian, subparallel linear stomata diverging posteriorly. Anterior spiracles having well-defined parastigmatic glands and removed laterally from apex of rostrum a distance equal to width of latter at base. Posterior spiracles placed a little anterior to middle of body, about equidistant from each other and margin of body. Median lobes of the pygidium divergent at 90 degree angle and projecting one-third their length from an obtuse posterior notch, well separated at bottom where there are two setae (plates), outer portion of interior margin minutely dentate. Exterior to median lobes a seta and between them and the divided second lobes a plate, between the second pair of lobules and the broad truncate third pair also a seta and a larger plate, another seta at base of outer lobule. Beyond the lobules the margin is very irregular, bearing four stout plates, one directly beyond, two near together at anterior end and one about midway between; the two segments of the preabdomen anterior each bear three shorter plates on or near the lateral

margin. There is a submarginal row of brevaceratubae or marginal pores as follows: 1 between 1 and 2 lobes, 2 between 2 and 3 lobes, 2 between 1 and 2 plates on lateris, 2 between 2 and 3 plates and 1 between 4 and 6 small plates; and four segmental rows consisting of a median and a lateral portion proceeding caudad on 2nd segment: 4 median and 9 lateral, on 3rd, 5 median and 7 lateral, on pygidium 5 median (in two rows) and 4 lateral. Anus a little anterior to center of pygidium. Circumgenital glands in five groups as follows: anterior 8, anterior laterals 16, posterior laterals 21. Pygidium in stained specimens displaying fine striations and several rows of longitudinal darker markings similar to paraphyses, behind median lobes.

Genus PINNASPIS Cockerell

(HEMICHIONASPIS)

Journ. Inst. Jam. I, p. 136 (1892).

The species included in this genus have the scale of the adult female more or less pyriform in outline, with the exuviae at the anterior extremity. First exuvia naked, second more or less covered by secreted matter. Secreted portion varying from white to brown or yellowish. The body of the female is elongate, broadened posteriorly, conspicuously segmented. Abdominal segments with a more or less distinct group of small nearly circular gland orifices on each side, more distinct near the pygidium. More or less distinct rows of oval gland orifices on the dorsal surface between the segments. A group of gland spines on each side of the abdominal segments, more distinct near the pygidium than anteriorly. The characters of the pygidium are as follows: One, two or three pairs of lobes present. Median lobes with their inner edges straight, parallel, and close to each other or touching for their entire length, the outer edges being rounded and either crenate or serrate. These two lobes together form approximately a semicircle, and are darker than the other lobes. Lobes of the second and third pairs, when present, composed of two lobules, of which the inner is larger than the outer. Gland spines simple and usually quite large and conspicuous. Spines usually plainly visible; those on the dorsal longer than those on the ventral surface. Circumgenital gland orifices always present and arranged in five groups. Scale of male elongate, unicarinate or tricarinate: ventral scale complete forming with the upper part a tube.

Type *P. pandani=buxi* (Bouché).

There are three species belonging to this genus in Hawaii, which may be differentiated as follows:

1. Second exuvia large, occupying more than one-third the puparium.. .*buxi*
   Second exuvia not so large 2
2. Median lobes small, somewhat sunken into the pygidium...... ..*aspidistrae*
   Median lobes crenate ....*minor*

Genus Howardia Berlese & Leonardi

Riv. Pat. Veg. IV, p. 347 (1896).

This genus will contain the somewhat peculiar species of the Diaspinae characterized as follows: Scale of the adult female more or less oval to elongate, with the exuviae at or near the margin. Scale usually covered by the outer layers of the bark of the host plant. Pygidium with median lobes well developed and with a pair of clubbed paraphyses. Circumgenital gland orifices wanting and without marginal gland orifices. Male scale unknown.

Type *H. biclavis* (Comst.).

There is but one species of this genus found in Hawaii, viz., the type species referred to above.

Genus Tsukushiaspis Kuwana

Imp. Jap. Dept. Agr. Sci. Bul. I, pt. 1, p. 30 (1928).

The species included in this genus of the Diaspinae have both female and male scales similar to those found in species of Chionaspis, that is, scale of the female elongate, narrow in front, more or less broadened behind, generally white or pale yellow, exuviae at the cephalic end; scale of the male small, elongate, slender, sides parallel or nearly so, white, generally tricarinate, exuvia terminal at the cephalic end. The body of the adult female is slender, sides nearly parallel, a more or less distinct row of oval gland orifices on the dorsal surface. Two pair of lobes present. Fimbriate processes (in the nature of squames) on the margin of the pygidium, shorter than lobes. No incisions or chitinous thickenings. Gland spines simple, much longer than lobes. Marginal gland orifices present, arranged as follows: 1 between the median lobes, on each side of the median lobes as 1, 1, 1. Anal opening small, nearer to the base than apex of pygidium. Circumgenital

gland orifices present, arranged in five groups. The distinctive characters are the presence of the fimbriate processes on the margin of the pygidium and the marginal gland orifice between the median lobes.

Type *T. pseudoleucaspis* (Kuw.).

There is but one species of this genus found in Hawaii, viz., the type species referred to above, which has previously been known as *Leucaspis bambusae*. It occurs commonly on a bamboo (*Phyllostachys* sp.).

Genus Fiorinia Targ.

Targ. Cat., p. 42 (1869).

The species included in this genus have but a single exuvia at basal extremity of female scale; the second is present but incloses the small adult female, the insect decreasing in size after second moult; the puparium so formed is more or less elongate narrow at the base, widening a little apically perhaps; sides, however, generally stated parallel, first larval exuvia extending beyond the margin. The male scales are white, elongate, with or without carinae, larval exuvia at anterior or basal extremity. Pygidium of adult female possessing well-defined median lobes (some species with a small pair on either side as well) and plates; circumgenital gland openings normally in five groups, although in some species the median and anterior laterals coalesce, forming an arch. Sometimes absent.

Type *F. fioriniae* Targ.

Two species belonging in this genus are found in Hawaii, which may be differentiated as follows:

With circumgenital gland openings, two pairs of lobes, spinous tubercles only on anterior portion of margin (on avocado).................*fioriniae*

Without circumgenital gland openings, only one pair of lobes, spinous tubercles along entire margin (on litchi).................*nephelii*

Genus Aspidiotus Bouché

Naturg. Schädl. Gart. Ins., p. 52 (1833).

This genus includes species of Diaspinae in which the scale of the female is circular or nearly so, with the exuviae at or near the center, and the scale of the male somewhat elongated, with

the larval skin at one side of the center or near one extremity. The last segment of the female usually presents four groups of spinnerets. In a few species there are five groups, and in some they are wanting.

Type *A. hederae* (Vall.).

Four species belonging to this genus are found in Hawaii, which may be differentiated with the following key:

1. Pygidium of adult female always without genacerores, scales grayish or yellowish .... *rapax* (*camelliae*)
   Pygidium of adult female always with genacerores 2
2. Pygidium of adult female always without densariae or paraphyses; scale very dull pale yellow, often whitish in well-protected specimens; thin, somewhat transparent; exuviae central, yellow, covered in newly molted adult females but usually bare in older individuals.... *hederae*
   Pygidium of adult female always with densariae or paraphyses. 3
3. Pygidium of adult female with three pairs of lobes; scale brownish yellow; exuviae central, bright yellow, covered with white secretion .... *cyanophylli*
   Pygidium of adult female with a single pair of lobes; scale clear yellow, translucent at center, exuviae large .... *lataniae*

Genus Chrysomphalus Ashm.

Am. Ent. III, p. 268 (1880).

This genus of the Diaspinae includes the species similar in most respects to the species of Aspidiotus *supra*; however, there are always paraphyses present, and in that particular they are different.

Type *C. ficus* Ashm.

There are four species belonging to this genus found in Hawaii, which may be differentiated by the use of the following key:

1. Circumgenital gland openings absent, scale orange or reddish (on citrus) .... *aurantii*
   Circumgenital gland openings present in adult female.......... 2
2. Two outer rows of dorsal gland openings numerous and each arranged in a double row; marginal plates beyond the third lobes strongly pectinate along their margins; scale blackish with the covered exuviae reddish (on citrus, Cycas, and coconut).......... *aonidum* (*ficus*)
   Two outer groups of dorsal gland openings few in number and each arranged in a single row.......... 3
3. A conspicuous pair of long, serrated plates laterad of third lobe; scale grayish-white, exuviae light yellow (on palms).......... *dictyospermi*
   Not so; that is without a conspicuous pair of long, serrated plates laterad of third lobe; scale deep, dull brown, almost black, nipple yellowish (on Araucaria) .... *rossi*

Genus ODONASPIS Leon.

Riv. Pat. Veg. V, p. 284 (1897).

Species included in this genus have the scale of the adult female circular or subcircular in outline with the exuviae placed to one side of the center. The scale of the male is more elongate and strongly convex above, exuviae near anterior extremity. Body of female is broadly oval, rather flat, with integument at caudal end strongly chitinized. Pygidium broad and triangular, terminating in a large and apparently single, fairly prominent median lobe, or the equivalent thereof; other lobes more or less indistinctly formed, merely indicated by lesser or slight prominences; no plates whatsoever but a few marginal spines present. Circumgenital glands usually present, also distinct paraphyses, and the pygidial area dotted with small pores or gland openings.

Type *O. secreta* (Ckll.).

Two species belonging to this genus are found in Hawaii, which may be differentiated with the following key:

Pygidium without incisions, anterior circumgenital glands 12-17, lateral 29-33, numerous dorsal pores on either side of median and second pair of lobes (on Bermuda grass)..*ruthae*

Pygidium with incisions, no anterior circumgenital glands, laterals in first group numbering 80-90, dorsal pores inconspicuous (on bamboo) *secreta*

Genus MORGANELLA Cockerell

U.S.D.A. Bul. Ent. t.s. 6, p. 22 (1897).

This genus of the Diaspinae includes species similar in most respects to the species of Aspidiotus *supra,* but may be distinguished therefrom by the following characteristics: Closely adjacent or contiguous median lobes, which are long and slender, absence of other lobes, and orifice at base of lobes, and especially the very long spines.

Type *M. maskelli* (Ckll.).

There is but one species of this genus found in Hawaii, viz., the above-named type species, which some authorities consider the same as *M. longispina,* the other species included in the genus.

Genus PSEUDAONIDIA Cockerell

U.S.D.A. Bul. Ent. t.s. 6, p. 14 (1897).

The species included in this genus of the Diaspinae are similar in most respects to the species of Aspidiotus *supra*, but there is a peculiarity in the pygidium of the adult female: the dorsal surface has a latticework design like that in Ischnaspis.

Type *P. duplex* (Ckll.).

There is but one species of this genus found in Hawaii, viz., *P. clavigera* Ckll.

LITERATURE CONSULTED

(1) 1867 Cat. Targioni-Tozzetti.

(2) 1868 Les Cochenilles. Signoret.

(3) 1887 Notes on British Coccidae. Douglas, Ent. Mo. Mag. XXIV, 21 *Ischnaspis filiformis=longirostris*, descr. & fig.

(4) 1887 Observations on Coccidae. Morgan, Ent. Mo. Mag. XXV, 352 *Aspidiotus longispina, dictyosperma*, descr. & fig.

(5) 1892 Museum Notes. Cockerell, Jn. Inst. Jam. I, 136. Descr. Genus Pinnaspis.

(6) 1894 Coccidae or Scale Insects. Cockerell, Bul. Bot. Dept. Jam I. Diagnosis Diaspines

(7) 1895 Coccid Notes. Maskell, Tr. N. Z. Inst. XXVII, 47. Descr. *Andaspis flava* var. *hawaiiensis*.

(8) 1896 Coccidae of Ceylon, Pts. 1 & 2. Green.

(9) '96-'01 Coccidae. Leonardi, Riv. Pat. Veg. IV, V, VII, VIII.

(10) 1901 South African Coccidae. Cockerell, Ent. 34, 225. Descr. *Aulacaspis cravei* var. *fulleri*.

(11) '97-'12 San Jose Scale & Allies. Cockerell, U.S.D.A. Bul. Ent. t.s. 6.

(12) 1912 Genus Fiorinia in the U. S. Sasscer, U.S.D.A. Bul. Ent. t.s. 16, pt. 5.

(13) 1898 *Fiorinia nepheli* descr. Maskell, Tr. N. Z. Inst. XXX, 234.

(14) 1899 Chionaspis & Hemichionaspis. Cooley, Spec. Bull. Mass. Exp. Sta. p. 8.

(15) '01-'03 Monograph of British Coccidae. Newstead.

(16) 1902 Coccidae of Japan. Kuwana, Pr. Cal. Acad. Sci. III, 43.

(17) 1902 Fauna Hawaiiensis: Hemiptera. Kirkaldy.

(18) 1903 Cat. Coccidae of the World. Fernald.

(19) 1903 Mytilaspides, Parlatoria. Leonardi, Bol. R. S. Agr. Portici V.

(20) 1905 Fiorinia. Leonardi, Redia III. .

(21) '05-'30 Proc. Haw. Ent. Soc. vols. I-VII.

(22) 1907 Notes on Coccidae Seychelles. Green, Tr. Linn. Soc. London Zool. XII, 2, 205, descr. & fig. *Mytilaspis auriculata*.

(23) '14-'15 Some Ceylon Coccidae. Rutherford, Bul. Ent. Res. V, 259. Descr. *Aulacaspis flacourtiae*.

(24) 1915 Cat. Coccidae Australia. Froggatt, N. S. W. Dept. Agr. Bul. 14.
(25) 1916 Coccidae of Indiana. Dietz & Morrison.
(26) 1916 Report on Scale Insects. Comstock, Ag. Ex. Sta. N. Y. Bul. 372.
(27) 1921 Coccidae. MacGillivray.
(28) '21-'22 *Pinnaspis simplex-Lepidaspidis uniloba.* Ferris, Bul. Ent. Res. 12, 214, descr.
(29) '21-'22 Coccidae from the Seychelles. Green & Laing, Bul. Ent. Res. 12, 128. Fig. *Diaspis flacourtiae.*
(30) 1923 Scale Insects of Florida. Merrill & Chaffin.
(31) 1924 Synonymical Notes on Coccidae. Morrison, Pr. Ent. Soc. Wash. 26, 231. *Aulacaspis flacourtiae=major.*
(32) '25-'31 Coccidae of Japan. Kuwana, Tech. Buls. Imp. Jap. Dept. Agr.
(33) 1926 Egyptian Coccidae. Hall, Egypt. Min. Agr. Bul. 72. Fig. *Odonaspis ruthae.*

Hymenopterous Parasites of the Coccidae, etc., in Hawaii

BY D. T. FULLAWAY

(Presented at the meeting of April 2, 1931)

PART I

Host List and Reference

Parasite	Host
Anagyrus swezeyi Timb. (1)*	*Trionymus insularis* Ehr.
† *Marietta graminicola* Timb. (2)	
" *nigricornis* Timb. (3)	*Trionymus insularis*
† *Marietta graminicola*	" *lounsburyi* (Brain)
	Pseudococcus longispinus (Targ.)
	Ripersia palmarum Ehr.
" *antoninae* Timb. (4)	*Antonina indica* Green
† *Marietta graminicola*	
† *Thysanus dactylopii* (Ashm.) (5)	
" *dactylopii* (How.) (6)	*Pseudococcus filamentosus* (Ckll.)
" spp.	Endemic spp. *Pseudococcus*
" *saccharicola* Timb.	*Trionymus sacchari* (Ckll.)
Leptomastidea abnormis (Gir.) (7)	*Pseudococcus krauhniae* (Kuwana)
Pauridia peregrina Timb. (8)	*Pseudococcus krauhniae*
Blepyrus insularis (Cam.) (9)	*Ferrisiana virgata* (Ckll.)
Protaenasius sp. (10)	*Ferrisiana virgata*
Coelaspidia osborni Timb. (11)	*Pseudococcus boninsis* (Kuwana)
† *Thysanus dactylopii*	
Encyrtus infelix (Embl.) (12)	*Saissetia hemispherica* (Targ.)
† *Quaylea whittieri* (Gir.) (13)	" *nigra* (Nietn.)
Encyrtus barbatus Timb. (14)	*Saissetia hemispherica*
	" *nigra*
Microterys kotinskyi (Ful.) (15)	*Coccus longulus* (Dougl.)
† *Quaylea whittieri*	" *viridis* (Green)
	Ceroplastes rubens Mask.
	Pulvinaria mammeae Mask.
	" *psidii* Mask.
	Saissetia nigra
" *flavus* (How.) (16)	Collected
Aphycus alberti How. (17)	*Coccus longulus*
" *claviger* Timb. (18)	Collected
" *terryi* Ful. (19)	*Pseudococcus boninsis*

* Numbers refer to citations of literature, Part II.
† Hyperparasite.

Pseudaphycus utilis Timb. (20)	*Pesudococcus nipae* (Mask.)
Aphycomorpha araucariae Timb. (21)	*Eriococcus araucariae* Mask.
Adelencyrtus odonaspidis Ful. (22)	*Odonaspis ruthae* Kot.
Anabrolepis extranea Timb. (23)	Collected ex diaspine
Anicetus annulatus Timb. (24)	*Eucalymnatus tessellatus* (Sign.)
Comperiella bifasciata How. (25)	*Aspidiotus rapax* Comst.
	" on bamboo
Arrhenophagus albipes Gir. (26)	*Phenacaspis eugeniae* (Mask.)
Xanthoencyrtus fullawayi Timb. (27)	*Pseudococcus boninsis*
" *apterus* Timb. (28)	*Trionymus insularis*
" spp.	
Plagiomerus hospes Timb. (29)	Diaspinae?
Tomocera californica How. (30)	*Saissetia nigra*
	" *oleae* (Bern.)
	Asterolecanium pustulans (Ckll.)
	Ceroplastes rubens
" *ceroplastis* Perk. (31)	*Ceroplastes rubens*
Scutellista cyaneae Mots. (32)	*Saissetia hemispherica*
† *Quaylea whittieri*	" *nigra*
	" *oleae*
Aneristus ceroplastae How. (33)	*Coccus longulus*
	" *viridis*
	Pulvinaria urbicola Ckll.
	Ceroplastes rubens
	Saissetia nigra
Coccophagus hawaiiensis Timb. (34)	*Saissetia nigra*
	Coccus viridis
" *ochraceus* How. (35)	*Coccus viridis*
Prospaltella koebelei How. (36)	*Morganella longispina* (Morg.)
" *bicolor* Timb. (37)	*Aspidiotus cydoniae* Comst.
	" *rapax*
" *transvena* Timb. (38)	*Aleyrodes vaporariorum* Westw.
	" *hibisci* Kot.
	" *sonchi* Kot.
	Aphis sacchari Zehnt.
Encarsia versicolor Gir. (39)	*Aleyrodes sonchi*
	" *vaporariorum*
" sp. (40)	" *sonchi*
	" *hibisci*
	" *vaporariorum*
Aspidiotiphagus citrinus (Craw) (41)	*Diaspis bromeliae* (Kern.)
	" *echinocacti* Comst.
	Aulacaspis rosae (Bouché)
	Parlatoria zizyphus (Lucas)
	Pseudoparlatoria giffardi
	Chrysomphalus aonidum (Linn.)
	" *rossi* (Mask.)
	Lepidosaphes auriculata (Green)

Aspidiotiphagus citrinus (Craw) (41)	*Lepidosaphes beckii* (Newm.)
	Aspidiotus perniciosus Comst.
	" *hederae* (Vall.)
	" *cyanophylli* Sign.
	Phenacaspis eugeniae
	Hemichionaspis minor (Mask.)
Aspidiotiphagus agilior Berl. (42)	*Parlatoria zizyphus*
	Fiorinia fioriniae (Targ.)
	Lepidosaphes beckii
Coccidencyrtus ochraceipes Gahan (43)	*Diaspis boisduvali* Sign.
Aphelinus maidis Timb. (44)	*Aphis maidis* Fitch
† *Aphidencyrtus inquisitor* (How.) (45)	" *sacchari*
" *gossypii* Timb. (46)	" *gossypii* Glover
	" *medicaginis* Koch.
" *semiflavus* How. (47)	*Toxoptera aurantii* (Fons.)
	Aulacorthrum circumflexum (Buck.)
Aphytis diaspidis (48)	*Howardia biclavis* (Comst.)
† *Marietta carnesi* (How.) (49)	*Diaspis bromeliae*
	" *echinocacti*
	Aulacaspis rosae
	Hemichionaspis minor
	Aspidiotus cydoniae Comst.
	Pinnaspis buxi (Bouché)
Aphytis chrysomphali (Mercet) (50)	*Diaspis bromeliae*
	Aspidiotus cyanophylli
	" *rapax*
	" *cydoniae*
	Hemichionaspis minor
	Chrysomphalus aonidum
	" *rossi*
	Lepidosaphes auriculata
	" *beckii*
	Pseudoparlatoria giffardi
Eretmocerus corni Hald. (51)	*Aleyrodes hibisci*
Archenomus perkinsi (Ful.) (52)	*Morganella longispina*
	Leucaspis indica
Pseudopteroptrix imitatrix Ful. (53)	*Howardia biclavis*
	Aspidiotus rapax
Signiphora aspidioti Ashm. (54)	" *cyanophylli*
	" *cydoniae*
" *thoreauini* Gir. (55)	Collected. Found in California
" sp. (56)	*Parlatoria* sp.
Astichus cyaneus Ashm. (57)	Collected

PART II

Citation of Literature

(1) Pr. H. E. S. IV, 199
(2) " VI, 180
(3) " IV, 197
(4) " IV, 409
Bul. Imp. Agr. Exp. Sta. Japan III, 84
(5) Pr. U. S. N. M. 22, 410
Bol. Lab. Zool. Agr. Portici XII, 266
(6) Pr. U. S. N. M. 21, 242
(7) Ent. 1915, 184
Calif. Mo. Bul. IV, 207
Jn. Econ. Ent. 10, 262
Univ. Calif. Pub. Ent. I, 366
(8) Pr. H. E. S. IV, 206
(9) " IV, 212
" V, 167
(10) ms. n.
(11) Pr. H. E. S. V, 330
(12) Tr. Ent. Soc. Lond. 1902, 223
(13) Pr. H. E. S. IV, 216
" V, 166
(14) Pr. H. E. S. IV, 209
Calif. Bull. 223
(15) Haw. Ag. Ex. Sta. Rep. 1912, 26
Pr. H. E. S. IV, 189
Calif. Bull. 223
(16) U. S. D. A. Rep. 1880, 367
(17) Pr. U. S. N. M. 21, 247
Calif. Bul. 223
(18) Pr. U. S. N. M. 50, 620
(19) Pr. H. E. S. II, 281
(20) " V, 323
Bd. Agr. & For. Rep. 1922, opp. 64
(21) Pr. H. E. S. IV, 225
(22) Haw. Ag. Ex. Sta. Rep. 1911, 27
(23) Pr. H. E. S. IV, 434
" V, 165
" V, 432
(24) Pr. H. E. S. IV, 227
(25) Ent. News XVII, 122
Univ. Calif. Ent. Bul. IV, 44, 65
(26) Jn. N. Y. Ent. Soc. XXIII, 242
Pr. Wash. Ent. Soc. IV, 135
(27) Pr. H. E. S. IV, 204
(28) " IV, 201
(29) " IV, 428
(30) U. S. D. A. Rep. 1880, 368
Calif. Bul. 223
(31) Pr. H. E. S. I, 76
(32) Etud. Ent. VIII, 172
Calif. Buls. 214, 223
(33) Can. Ent. XXVII, 351
Ins. Life VI, 231
Bol. Lab. Zool. Agr. Portici IX, 356
(34) Pr. H. E. S. VI, 315
Pr. U. S. N. M. 78, art. 7, 55
(35) U. S. D. A. Bul. Ent., t.s., I, 38
(36) An. Ent. Soc. Am. I, 282
(37) Pr. H. E. S. VI, 310
(38) " VI, 312
(39) Psyche XV, 53
(40) U. S. D. A. Bul. Ent. t.s. I, 28
Bol. Lab. Zool. Agr. Portici IX, 365
(41) Ins. Life VI, 230
Calif. Bul., 214
(42) Redia XII, 5
(43) Pr. U. S. N. M. 71, art. 4, 18
Pr. H. E. S. VI, 517
(44) " V, 405
" V, 410
" V, 436
(45) U. S. D. A. Rep. 1880, 367
Pr. H. E. S. VII, 209

(46) Pr. H. E. S. V, 408
(47) Ent. News XIX, 367
(48) U. S. D. A. Rep. 1880, 355
Pr. H. E. S. V, 411, 437
(49) Ent. News XXI, 162
Univ. Calif. Pub. Ent. IV, 71
U. S. D. A. Bul. Ent. t.s. I, 20
(50) Bol. Soc. Espan. XII, 135
Pr. H. E. S. VI, 315
(51) Am. Jn. Sc. IX, 110
U. S. D. A. Bul. Ent. t.s. I, 15
Bol. Lab. Zool. Agr. Portici IX, 366
(52) Haw. Ag. Ex. Sta. Rep. 1912, 28
Pr. H. E. S. V, 438
Pr. Ent. Soc. Wash. IV, 136
(53) Pr. H. E. S. III, 464
" V, 439
(54) Pr. U. S. N. M. 22, 412
(55) Psyche XXIII, 41
Ins. Life VI, 234
Pr. H. E. S. V, 439
(56) Pr. H. E. S. V, 439
(57) F. H. I (3), 326
Pr. H. E. S. V, 439

PART III

Keys Useful in the Discrimination of Species

Key 1

To Subfamilies Encyrtidae
Aphelinidae
Signiphoridae
Pteromalidae

(including all the hymenopterous parasites of Coccidae, etc., in Hawaii)*
viz:—

Chalcids with the thorax not strongly developed, pronotum small, frequently not visible in the middle, with hind femora not greatly enlarged, with hind wings not linear, not pedunculate at base, with ovipositor usually issuing in front of tip of abdomen, with antennae 5-13 jointed, 1, 2 or 3 of which may be ring joints, and generally elbowed, with tarsi 4 or 5 jointed, hind tibiae sometimes with a large curved spur.

1. Mesoternal pleurae not visible; mid-legs long, saltatorial, with a very long tibial spur. 2
   Mesosternal pleurae distinct, mid-legs not saltatorial, first tarsal joint not swollen 3
2. Antennae 6-jointed, marginal vein about as long as subcostal.......... *Signiphoridae*
   Antennae 11-jointed, occipital margin of vertex usually acute; notauli obliterated .... *Encyrtidae*
3. Antennae 13-jointed with two ring-joints and 3 joints to the club; occipital line incomplete. .... *Pteromalidae*
   Antennae never more than 8-jointed; notauli distinct; middle tibial spur moderately long.......... *Aphelinidae*

* In limiting scope of keys to four subfamilies of Chalcidae *supra*, following hymenopterous parasites of Aphidae left out of consideration:
Lysiphlebus testaceipes
Ephedrus incompletus
Diaeretus rapae
Pachyneuron siphonophorae
Eucoila sp.

Key 2

To Species of Signiphora
(monotypical)

1. With a well-developed discal bristle on fore-wing, antennal club proportionately shorter and wider .... sp. indet.
   Without discal bristle on fore-wing, antennal club proportionately longer and narrower 2
2. Antennal club all black, cephalic mesoscutum only slightly darkened, band on abdomen shorter .... *thoreauini*
   Only apical half antennal club dark, anterior half mesoscutum and broad transverse band at base of abdomen dark brown, wings with broad fuscous band .... *aspidioti*

Key 3

To Encyrtid Species

Females

1. Antennae compressed, short and wide relatively 2
   Not so 5
2. Ochraceous-orange species .... *Anicetus annulatus*
   Blue-black to green or metallic-brown 3
3. Wingless, metallic brown .... *Coelaspidia osborni*
   Not so, winged 4
4. Pedicel and funicle joints more or less terete .... *Protaenasius* sp.
   Pedicel and funicle joints not terete, wings with fuscous rays .... *Comperiella bifasciata*
5. Head broad or thick (fronto-occipitally), face and fronto-vertex not in the same planes 6
   Not so; head thin, or fronto-vertex and face more or less confluent 16
6. Anterior margin of the fronto-vertex carinate 7
   Not so 9
7. Submarginal vein much thickened just before its apex and very slender before the thickening .... *Pauridia peregrina*
   Without this thickening in the submarginal vein 8
8. Fronto-vertex nearly but not quite as wide as long .... *Aphidencyrtus inquisitor*
   Fronto-vertex wider than long .... *Coccidencyrtus ochraceipes*
9. Forewings marked with fuscous rays .... *Anabrolepis extranea*
   Not so 10
10. Forewings banded .... *Microterys kotinskyi*
    Not so 11
11. Forewings with infuscated areas .... *Adelencyrtus odonaspidis*
    Forewings clear 12
12. Ovipositor exserted .... *Quaylea whittieri*
    Not so 13
13. Antennae white-tipped 14
    Antennae black-tipped 15
14. Orange-yellow species .... *Pseudaphycus utilis*
    Fuscous gray-brown species .... *Aphycus terryi*

15. Black band and spot on antennal scape .... *Aphycus alberti, claviger*
No band or spot on antennal scape .... *Aphycomorpha araucariae*
16. Antennae long, slender, filiform........ 17
Not so 23
17. Antennae with scape same diameter and thickness as flagellum 18
Antennae with scape compressed and more or less expanded.. 19
18. Wingless species........ *Xanthoencyrtus apterus*
Winged, and wings banded with fuscous discal ciliation .... *Leptomastidea abnormis*
19. Antennal scape compressed, but not greatly expanded........ 20
Antennal scape much expanded, more than ½ as wide as long . . 21
20. Antennal scape about ⅓ as wide as long, black banded on white .... *Anagyrus swezeyi*
Antennal scape about one-half as wide as long, not banded, black with a white line on dorsal edge forming a collar at distal end, white on distal half pedicel and entirely white beyond 1st funicle joint .... *Anagyrus saccharriola*
21. Antennae white beyond 2nd funicle joint .... *Anagyrus dactylopii*
Not so 22
22. Antennae black except for two white bands on scape. .... *Anagyrus nigricornis*
Antennae white-tipped (all of club), otherwise mostly black (only a white band apex scape, white pedicel except at base and whitish on parts of 5th and 6th funicle joints). .... *Anagyrus antoninae*
23. Wings clear, no hair tufts on scutellum........ 24
Wings fuscous, tuft of hairs on scutellum 25
24. Antennae 3-jointed .... *Arrhenophagus albipes*
Antennae 11-jointed........ *Blepyrus insularis*
25. Face distinctly lineolate, beard on cheeks long and conspicuous .... *Encyrtus barbatus*
Not so .... *Encyrtus infelix*

Key 4

To Species of Aphelinidae

Females

1. Tarsi 5-jointed 2
Tarsi 4-jointed 19
2. Forewings with an obliquely transverse hairless line below stigma.... 3
Forewings without this hairless line below stigma. 9
3. Wings mottled 4
Not so 5
4. Antennal scape broadly expanded beneath, width nearly half the length (excluding radicle) and twice width of pedicel. ..*Marietta graminicola*
Antennal scape slender, no wider than pedicel........ *Marietta carnesi*
5. Head and thorax not differing greatly in width, ovipositor comparatively strong and entirely free so that in oviposition it descends almost perpendicularly from near the base of the abdomen........ 6

Head broad, body tapering behind to the apex of the abdomen, ovipositor comparatively tenuous and enclosed entirely by the ventrites so that in oviposition it is protruded backward in a more or less horizontal position 7

6. Lemon-yellow species, wings clear, discal ciliation base of wings sparser .... *Aphytis chrysomphali*

Orange-yellow species, wings and abdomen somewhat fuscous, discal ciliation wings close and fine .... *Aphytis diaspidis*

7. Body partly black or brown, speculum of forewing bounded basad by several rows of setae 8

Speculum banded basad by one and one-half rows of setae or by one row and several more or less scattered setae just beneath the marginal vein; abdomen yellowish on basal segment .... *Aphelinus gossypii*

8. Wings large and comparatively wide, the disc beyond the speculum finely and densely pubescent, the marginal fringe comparatively short and often inconspicuous .... *Aphelinus maidis*

Wings comparatively small and narrow, the stigmal vein reaching far beyond the middle of the costal margin, the disc beyond the speculum with coarser, sparser setae, the marginal fringe comparatively long and conspicuous; abdomen except the lateral margins usually wholly yellow; the male with elongate antennae, the third funicle joint not much shorter than the long, slender club .... *Aphelinus semiflavus*

9. Antennae 7-jointed (scape, pedicel, 4 ring joints and a moderately long club) .... *Thysanus dactylopii*

Antennae 8-jointed 10

10. Antennal club 2-jointed 11

Antennal club 3-jointed 12

11. Pale cadmium yellow species marked with variable dusky, basal half of forewings which are narrow, slightly dusky, naked area beyond and below stigmal vein reaching costal edge, bare path also around margin apical half wing, marginal fringes of forewings long, especially caudo-apically .... *Encarsia versicolor*

Bright yellow species with wings wholly hyaline, disc of wing rather broad, without a bare area beyond the stigmal vein, marginal fringe less than one-half width of disc .... *Encarsia* sp.

12. Stigmal vein lacking, wings with a very long fringe 13

Stigmal vein present, marginal cilia comparatively short 14

13. Antennae longer, anterior wings proportionately larger, discal ciliation closer, more extensive, infuscation deeper .... *Aspidiotiphagus citrinus*

Antennae shorter, anterior wings proportionately smaller, discal ciliation sparser and less extensive, infuscation fainter ....
.... *Aspidiotiphagus agilior*

14. Marginal vein shorter than the submarginal 15

Marginal vein as long as or longer than the submarginal 17

15. Black species with pale yellow scutellum .... *Prospaltella bicolor*

Not so 16

16. Orange yellow species with yellow antennae, hyaline wings and long marginal fringes.................... ..*Prospaltella transvena*

 Varicolored species: abdomen and pronotum brown, head entirely yellow, meso and metanotum dark yellow, legs pallid except hind femora which are dusky, antennae yellow, pedicel and last two funicle joints darker, wings hyaline, disc forewings below marginal vein faintly infuscated ....*Prospaltella koebelei*

17. Antennal scape short, flagellum shortly flattened, hind tibiae flattened and with a row of short bristles above........ *Aneristus ceroplastae*

 Antennal scape not especially short, flagellum subcylindrical, hind tibiae normal 18

18. Ochraceous or dark honey yellow, antennae yellowish except pedicel, which is blackish, legs concolorous with thorax; antennae moderately long, first funicle joint only a little longer than wide; wings hyaline, veins fuscous. .... *Coccophagus ochraceus*

 Black, rather shiny on thorax and abdomen, scutellum except basal third and very narrow metanotum yellow; scape dusky yellowish, flagellum piceous, middle and hind coxae and hind tibiae yellowish white, front coxae and front femora, middle femora and tibiae in large part and hind femora except basal third more or less brownish or fuscous; antennae longer, first funicle joint more than twice as long as wide; wings hyaline and very faintly tinged with fuscous, veins yellowish. . ... *Coccophagus hawaiiensis*

19. Antennae 5-jointed, funicle joints 1 and 2 ring joints (male antennae 3-jointed, club very long, bent) .... *Eretmocerus corni*

 Antennae 8-jointed 20

20. Club 3-jointed, funicle joints about the same length widening a little outwardly .... *Pseudopteroptrix imitatrix*

 Club 3-jointed, second funicle joint transverse, only half the length of 1st and 3rd .... *Archenomus perkinsi*

Key 5

To Pteromalid Species

1. Scutellum exceptionally large, five times as long as pronotum, extending out over the abdomen to its middle, head broad and short, seen from in front triangular, antennae attached beneath middle of face, 8-segmented, scape fairly long, cylindrical, pedicel nearly as long as two first segments flagellum, these as long as broad, the following segments becoming somewhat shorter and broader, club not divided, as long as the three preceding segments together, pronotum very short with sharp anterior margin, parapsidal furrows complete and well marked, radial vein of wings shorter than the marginal, postmarginal half its length, abdomen short oval, as long as head and thorax together, 1st segment occupying first half, ovipositor only a little protruding.......................... *Scutellista cyanea*

 Scutellum not exceptionally large and not extending beyond the thorax 2

2. A fascia of hairs on either side at base of abdomen (on 2nd segment), head large and wide, strongly incised behind, antennae 10-segmented, marginal vein scarcely longer than the radius, postmarginal absent, 2nd segment of abdomen very large, occupying largest part of dorsum, antennae of male toothed..*Tomocera californica*

   Without two large subcircular (apparently slightly raised) areas of very dull appearance owing to covering of minute microscopic tomentum as in *californica,* hind coxae never dark and metallic on basal part, uniformly testaceous or brownish yellow, the large post-petiolar segment of abdomen uniformly smooth................*Tomocera ceroplastis*

The Biological Control of the Coconut Moth (*Levuana iridescens* Beth.-Baker) in Fiji—Book Review

BY F. MUIR

(Presented by O. H. Swezey at the meeting of May 7, 1931)

The publication of "The Coconut Moth in Fiji," by Messrs. J. D. Tothill, T. H. C. Taylor and R. W. Paine, is a notable event in the history of biological control of insect pests. It is of interest to entomologists in Hawaii for the reason that they have had personal contact with the entomologists of Fiji for a number of years, and there has been a number of return visits between them. Thus they have come to know one another's problems fairly well.

In 1905, when I first visited Fiji, this moth was confined to a part of the island of Viti Levu, although it had then been known in the island for nearly thirty years. It was then causing the authorities anxiety, and I was consulted by the Governor, and the Superintendent of Agriculture, as to possible remedies. I advised biological control measures, and suggested some of the islands in the Southwest Pacific as the probable home of the moth, and therefore the most likely place to find suitable parasites. I believe Albert Koebele had given similar advice some months earlier. The Governor, who was also a well-known zoologist, appeared interested in the idea, but it was twenty years before the advice was acted upon. It would be interesting to know the various reasons for the long delay. One reason, I feel quite sure, was the attitude of antagonism of most economic entomologists to biological control in 1905, and for some ten or fifteen years after. Except for a small group of entomologists in the United States, a small group in Hawaii and a few individuals in Europe, the whole of the economic entomological world was opposed to this principle of control. In 1910, a leading British economic entomologist told me that I was a fool for wasting my time; that I should do no good, but a lot of harm. Time brought a change, and this entomologist lived to advocate biological control himself, although he never had a proper understanding of the subject.

Proc. Haw. Ent. Soc., VIII, No. 1, Nov., 1932.

One of the factors bringing about this change was the economic success attained in the Hawaiian Islands.

It is possible that this coconut pest could have been controlled by artificial means, but the expense would have been greater than the industry could bear.

One of the things that has been brought out in the report is the gregariousness of *Levuana iridescens* Beth.-Baker, but I do not think enough use has been made of this to account for its slow rate of spread, and for some of its most marked characteristics. The larvae, upon hatching from the eggs, do not disperse, but feed together, and only the exhaustion of the food compels them to move to another leaf; even when full-grown they do not seek solitude to pupate, like so many moth larvae, but congregate in masses to such an extent as to lead to the death of many pupae.

The adult has well developed wings and, if endowed with a wanderlust, would soon have spread over Viti Levu, and even to other islands; but it has a strong nostalgia and will not seek new quarters, even to oviposit, but prefers leaves upon which Levuana larvae are feeding. This leads to the enormous Levuana population in small areas, to the destruction of all its food plant and to the great economic loss; it also is accountable for the very slow spread of the insect. This pyschology also played an important part in the control by the introduced Tachinid (*Ptychomyia remota* Ald.), as the percentage of parasitism as a rule, can rise higher in dense than in sparse populations.

We have a somewhat parallel case in Hawaii in *Anomala orientalis* (Waterh.). This beetle spread very slowly, and increased to enormous numbers in the area of infestation. When the Anomala population became very dense it was often decimated by bacteria. The adult is a good flyer and it was a problem to account for its slow spread, as they were taken feeding on several plants. It was soon found that only males, and females that had already oviposited, frequented flowers; it was seldom that a gravid female was taken feeding. Mating takes place as soon as the female matures, and she deposits her eggs in the vicinity. This was an important factor in its control by *Scolia manilae* Ashm., as the parasite did not have to expend much energy in seeking its host. Thus we see a parallelism due to different causes.

Ptychomyia remota is not a native parasite on *Levuana iridescens,* but is attached to other, but allied, genera in Java and Malay States; *Scolia manilae* is also attached to allied species of Anomala in the Philippines, where *A. orientalis* is unknown. These two parasites have perfect control over their hosts in their new habitats. This indicates that it may be possible to use a foreign parasite to control a native insect under certain conditions.

It is fortunate, from a scientific viewpoint, that no other death factor of importance was established along with *Ptychomyia remota,* as it demonstrates once more what a single parasite can achieve under favorable conditions. Tachinids have a wonderful faculty of finding their hosts, and therefore their critical point of parasitism is often high. The Tachinid on our own sugar cane beetle borer finds its hosts, although they are embedded in the stalk of the sugar cane. The fecundity of *Ptychomyia remota* is very much lower than that of *Ceromasia sphenophori* Vill., but then the former places its eggs upon its host, whereas the latter has to deposit them in the runs of the beetle borer larvae, and the Tachinid grubs have to find their host for themselves. The more direct the contact between the host and parasite, the less need for high fecundity.

As *P. remota* has alternate hosts in Fiji it is likely to spread beyond the range of Levuana, and so be on the spot, should Levuana spread. This is the case with *Scolia manilae,* which exists on Adoretus far beyond the present range of Anomala.

The account of Chalcid B and Chalcid A on Artona in Java (p. 240), and the injurious effects the latter has upon the former, recalls the limiting effect the hyperparasite has upon the Dryinidae in Hawaii.

In studying the Levuana work in Fiji, entomologists in Hawaii will find a number of phases of interest, on account of their similarities to those of their own work.

As the three authors spent some time in Hawaii, it is strange that the only reference to the work here is incorrect. They state that the beetle borer (*Rhabdocnemis obscura* [Boisd.]) threatened to destroy the sugar industry in Hawaii, and that its parasite (*Ceromasia sphenophori*) was introduced from Java. This Tachinid parasite is not known in Java, but in Amboina, Ceram and New Guinea, and was introduced from the last-mentioned locality. The

beetle borer has been in Hawaii for over sixty years and the sugar industry expanded in spite of it. It is true that it exacted a heavy toll during all these years, but it never threatened the life of the industry. It was the leafhopper (*Perkinsiella saccharicida* Kirk.) that did this, and *Anomala orientalis* might have ruined some of the most fertile areas of the Islands, if it had not been controlled.

"The Coconut Moth in Fiji" is published in a beautiful manner, the letter press and illustrations being exceedingly good. The Imperial Institute of Entomology must be given the credit for this.

The entomologists in Hawaii, through considerable experience, are well acquainted with the difficulties and dangers of all such work, and they congratulate all those who took part in finding and introducing and establishing *Ptychomyia remota* in Fiji.

Irritation Caused by the Sting of the Bethylid Wasp, Holepyris Hawaiiensis Ashm.

BY C. E. PEMBERTON

(Presented at the meeting of Sept. 3, 1931)

During June and July, 1931, a family resident on the beach at Niu, Honolulu, has been greatly annoyed by the irritation resulting from stings by a small bethylid wasp, determined by Dr. F. X. Williams as *Holepyris hawaiiensis* Ashmead.

This little wasp was found to occur rather commonly about the house and was no doubt breeding upon some small lepidopterous larva occurring either in the woodwork of the house, in stored foods or in dried and broken Algaroba seed pods, *Prosopis juliflora*, or other vegetation which is abundant and adjacent to the house. The host larva was not found. The insect was found in the bed clothing and in and on the clothes of the persons concerned. It stung readily when crushed or held in the clothing against the skin. Since it naturally searches in crevices and concealed places in search of its host, it frequently gets into clothing and bedding.

The immediate sensation following attack is comparable to that of an exaggerated mosquito bite. However, the itching and slight smarting of the affected spot usually lasts for several days and is accompanied by a swelling or welt a half inch or more in diameter which terminates as a dark blotch on the skin which may last for one or two weeks.

Similar, but much more violent effects have been caused in California by a somewhat similar bethylid wasp, *Epyris* sp., near *clarmontis* Kieffer. This has been described in detail in Science, Vol. LXV, No. 1682, pp. 302-303, March 25, 1927.

Holepyris hawaiiensis was found in quantity in the warehouses of the Union Feed Company in Honolulu in December, 1919, by J. C. Bridwell, where lepidopterous insects favoring stored food

products were common. E. M. Ehrhorn has reared it from *Ephestia cautella.*

This species has been studied by J. C. Bridwell and Dr. F. X. Williams. An account of its habits by Bridwell appears in Proc. Haw. Ent. Soc., Vol. IV, No. 2, pp. 311-14, 1919.

The Host Trees of the Endemic Cerambycidae in Hawaii

BY O. H. SWEZEY

(Presented at the meeting of May 7, 1931)

At the present time there are known 82 species and 4 varieties of endemic Cerambycidae in the Hawaiian Islands. They are distributed in the following genera: Plagithmysus, 49 species and 2 varieties; Nesithmysus, 4 species; Aeschrithmysus, 2 species; Callithmysus, 2 species and 1 variety; Neoclytarlus, 22 species and 1 variety; Paraclytarlus, 3 species. The descriptions of these are somewhat scattered, and many of them have no definite reference to their host trees. There are scattered notes recording habits of some of them later than the time of description. It seems desirable for convenient reference for those making further studies of this group of beetles, to have a list of all species together with their hosts so far as known. The following list also cites the decription, synonomy, collector and the island on which the species occurs. So far, no species is known to occur on more than one island. The list is arranged in chronological order according to dates of descriptions. A few host and locality records have been added while this paper was in press.

Plagithmysus pulverulentus (Motsch.).

Stenopterus pulverulentus Motschoulsky, Bull. Mosc., XVIII, I, p. 85, Pl. I, f. 12, 1845.

Plagithmysus pulverulentus Motsch., Bull. Mosc., XVIII, II, p. 370, Pl. VII, f. 7, 1845.

Plagithmysus pulverulentus, Sharp, Ent. Mo. Mag., (2), VII, p. 242, 1896.

Clytarlus robustus Sharp, Trans. Ent. Soc., London, p. 206, 1878.

Plagithmysus pulverulentus, Sharp, Fauna Hawaiiensis, II, p. 107, 1900.

Generally distributed on OAHU. Collected from *Acacia koa* by Blackburn and Perkins. Bred from the same tree by Swezey, Bridwell and Hadden. Oahu (Koebele); Wailupe (Bridwell); Tantalus (Giffard).

Plagithmysus cristatus (Sharp).

Clytus attenuatus Boisd., Voy. Astrol., Ins. II, p. 485, 1835.

Clytarlus cristatus Sharp, Trans. Ent. Soc., London, p. 207, 1878.

Plagithmysus cristatus Sharp, Ent. Mo. Mag., (2) VII, p. 274, 1896.

Proc. Haw. Ent. Soc., VIII, No. 1, Nov., 1932.

Plagithmysus cristaus Sharp, Fauna Hawaiiensis, II, p. 113, 1900.
Callithmysus cristatus Sharp, Fauna Hawaiiensis, III, p. 650, 1910.
Plagithmysus cristatus, Perkins, Proc. Haw. Ent. Soc., VI, p. 479, 1927.

Generally distributed on OAHU. Collected on *Acacia koa* by Blackburn and Perkins. Bred from the same tree by Swezey and Hadden. Oahu (Koebele); Tantalus (Giffard); Palolo, Punaluu (Swezey).

Plagithmysus finschi (Harold).

Clytarlus finschi Harold, Mitt. München Ent. Ver., IV, p. 166, 1880.
Plagithmysus finschi, Sharp, Ent. Mo. Mag., (2), VII, p. 242, 1896.
Plagithmysus finschi, Sharp, Fauna Hawaiiensis, II, p. 106, 1900.

Olinda and Haleakala, MAUI. Collected on *Acacia koa* by Blackburn and Perkins. Bred from the same tree by Swezey. Maui (Koebele); Olinda (Giffard and Fullaway).

Plagithmysus pulvillatus (Karsch).

Clytarlus pulvillatus Karsch, Berlin Ent. Zeit., XXV, p. 9, Pl. I, f. 14, 1881.
Plagithmysus pulvillatus, Sharp, Fauna Hawaiiensis, II, p. 111, 1900.

"Grove Ranche", MAUI (Karsch). Collected by Perkins on Haleakala, 5,000 ft. Maui, on *Metrosideros polymorpha*.

Plagithmysus blackburni (Sharp).

Clytarlus blackburni Sharp, Trans. Dublin Soc., (2), III, p. 195, Pl. V, fig. 47, 1885.
Plagithmysus blackburni Sharp, Ent. Mo. Mag., (2), VII, p. 271, 1896.
Plagithmysus blackburni Sharp, Fauna Hawaiiensis, II, p. 111, 1900.

Kona and Puuwaawaa, HAWAII. Collected on *Sophora chrysophylla* by Perkins and Giffard; by Blackburn on *Acacia falcata* (possibly a misidentification of tree); by Meinecke on Sophora on Mauna Kea, and at Humuula on dead Gouldia; by Williams and Swezey on Sophora at 7,000 feet elevation, Nauhi Gulch, Hawaii, Oct., 1931.

Plagithmysus vitticollis Sharp.

Sharp, Ent. Mo. Mag., (2), VII, p. 240, 1896.
Sharp, Fauna Hawaiiensis, II, p. 105, Pl. VI, fig. 5, 1900.

Kilauea, HAWAII (Perkins, Giffard, Swezey). Collected on akala (*Rubus* sp.) by Perkins; on *Perrottetia sandwicensis* by Giffard. Bred from *Rubus hawaiiensis*, Upper Hamakua Ditch trail, Kohala Mts. (Swezey).

Plagithmysus vitticollis var. **longulus** Sharp.
Sharp, Ent. Mo. Mag., (2), VII, p. 240, 1896.
Sharp, Fauna Hawaiiensis, II, p. 105, 1900.

Puna, HAWAII. Found breeding in *Bobea elatior* by Perkins. Collected on the same tree at Kilauea by Giffard. Collected at Puna by Newell; Hawaii (Koebele).

Plagithmysus newelli Sharp.
Sharp, Ent. Mo. Mag., (2), VII, p. 240, 1896.
Sharp, Fauna Hawaiiensis, II, p. 105, Pl. VI, fig. 7, 1900.

Wailuku, MAUI. Collected by Blackburn. Host tree unknown. Haleakala, 4,000 feet (Giffard).

Plagithmysus concolor Sharp.
Sharp, Ent. Mo. Mag., (2), VII, p. 241, 1896.
Sharp, Fauna Hawaiiensis, II, p. 106, Pl. VI, fig. 8, 1900.

KAUAI. Collected on ohia ha (*Syzygium sandwicense*) by Perkins and oviposition was observed on this tree; collected by Munro at Kaholuamano; Waimea, 3,200 to 4,000 feet, Kaholuamano (Giffard); Kaholuamano, Waialeale trail (Kusche); collected on ohia lehua by Osborn at Kokee. Bred from lehua at Halemanu by Swezey, July, 1932.

Plagithmysus solitarius Sharp.
Sharp, Ent. Mo. Mag., (2), VII, p. 241, 1896.
Sharp, Fauna Hawaiiensis, II, p 106, 1900; III, p. 647, 1910.

Mt. Tantalus, Nuuanu, Pupukea, Haleauau, OAHU. Bred from *Syzygium sandwicense* by Perkins and Swezey; and from *Elaeocarpus bifidus* by Swezey and Hadden; on Tantalus, once bred from *Metrosideros polymorpha* by Perkins; Oahu (Koebele): Lanihuli (Bryan). Bred from lehua in Mohiakea Valley, Waianae Mountains, by Swezey, Sept., 1932.

Plagithmysus cuneatus Sharp.
Sharp Ent. Mo. Mag., (2), VII, p. 241, 1896.
Sharp, Fauna Hawaiiensis, II, p. 106, Pl. VI, fig. 9, 1900.

Kaala, OAHU. Collected by Perkins on an unknown tree; collected by Forbes on *Sapindus oahuensis* at Wailupe. Bred from the same tree at Niu by Swezey and Williams, March, 1932.

Plagithmysus bishopi Sharp.
Sharp, Ent. Mo. Mag., (2), VII, p. 242, 1896.
Sharp, Fauna Hawaiiensis, II, p. 108, Pl. VI, fig. 12, 1900; F. H., Int., p. lxviii, 1913.

Kilauea, HAWAII. Bred by Perkins from *Pelea cinerea* and *Xanthoxylum dipetalum* var. *geminicarpum*; collected from the same trees by Giffard; also collected by Giffard on *Pelea zahlbruckneri*, *Straussia* sp. and *Acacia koa*.

Plagithmysus bishopi var. **gracilis** Sharp.
Sharp, Ent. Mo. Mag., (2), VII, p. 243, 1896.
Sharp, Fauna Hawaiiensis, II, p. 108, 1900.

Kilauea, HAWAII. Collected by Perkins from a tree resembling pua (*Osmanthus sandwicensis*).

Plagithmysus vicinus Sharp.
Sharp, Ent. Mo. Mag., (2), VII, p. 243, 1896.
Sharp, Fauna Hawaiiensis, II, p. 108, 1900; F. H., Int., p. lxviii, 1913.

Western side of Mauna Loa, HAWAII. Collected from a different species of Pelea than that from which *bishopi* was bred.

Plagithmysus bilineatus Sharp.
Sharp, Ent. Mo. Mag., (2), VII, p. 243, 1896.
Sharp, Fauna Hawaiiensis, II, p. 108, Pl. VI, fig. 14, 1900.

Kilauea, Puna and Kona, HAWAII. Collected on ohia lehua (*Metrosideros polymorpha*) by Perkins; collected on the same tree at Kilauea by Giffard.

Plagithmysus lanaiensis Sharp.
Sharp, Ent. Mo. Mag., (2), VII, p. 244, 1896.
Sharp, Fauna Hawaiiensis, II, p. 108, 1900.

Halepaakai, LANAI. Collected by Perkins and said to be probably attached to ohia lehua.

Plagithmysus perkinsi Sharp.
Sharp, Ent. Mo. Mag., (2), VII, p. 244, 1896.
Sharp, Fauna Hawaiiensis, II, p. 109, Pl. VI, fig. 15, 1900.

Mauna Loa and Kilauea, HAWAII. Collected on *Myoporum sandwicense* by Perkins and Giffard; bred from the same tree by Giffard and Swezey. Bred from the same tree at Nauhi Gulch, 6,000 ft., by Swezey, Sept., 1931.

Plagithmysus varians Sharp.
Sharp, Ent. Mo. Mag., (2), VII, p. 245, 1896.
Sharp, Fauna Hawaiiensis, II, p. 109, 1900.

Mauna Loa and Kilauea, HAWAII. Collected very abundantly from *Acacia koa* by Perkins and Giffard; bred from the same tree by Swezey at Nauhi, 5,250 feet elevation, Oct., 1931.

Plagithmysus darwinianus Sharp.

Sharp, Ent. Mo. Mag., (2), VII, p. 271, 1896.
Sharp, Fauna Hawaiiensis, II, p. 109, Pl. VI, fig. 16, 1900; F. H., Int., p. lxvii, 1913.

Kilauea, HAWAII. Collected on mamani (*Sophora chrysophylla*) by Perkins and Giffard; ten specimens collected on fallen *Sapindus saponaria* tree, September 28, 1913, by Swezey. Not known to breed in this latter tree.

Plagithmysus sulphurescens Sharp.

Sharp, Ent. Mo. Mag., (2), VII, p. 271, 1896.
Sharp, Fauna Hawaiiensis, II, p. 111, Pl. VI, fig. 17,* 1900.

Kilauea, HAWAII. Collected by Perkins from an unknown tree. Later recorded as breeding in Urera.

Plagithmysus speculifer Sharp.

Sharp, Ent. Mo. Mag., (2), VII, p. 272, 1896.
Sharp, Fauna Hawaiiensis, II, p. 111, 1900.

Iao Valley, MAUI. Collected by Perkins. Host tree not known.

Plagithmysus aestivus Sharp.

Sharp, Ent. Mo. Mag., (2), VII, p. 272, 1896.
Sharp, Fauna Hawaiiensis, II, p. 111, 1900.

MOLOKAI. Collected by Perkins on ohia lehua (*Metrosideros polymorpha*); on the same tree by Giffard at Kalamaula, Molokai.

Plagithmysus funebris Sharp.

Sharp, Ent. Mo. Mag., (2), VII, p. 273, 1896.
Sharp, Fauna Hawaiiensis, II, p. 106, Pl. VI, fig. 10, 1900.

Haleakala, MAUI. Collected by Perkins on *Sophora chrysophylla*; bred from the same tree in 1927 by Swezey; Maui (Koebele); south slope of Haleakala (Forbes).

Plagithmysus aequalis Sharp.

Sharp, Ent. Mo. Mag., (2), VII, p. 273, 1896.
Sharp, Fauna Hawaiiensis, II, p. 112, 1900.

Makaweli, Waimea, Kaholuamáno, KAUAI. Collected by Perkins on *Acacia koa*; Kaholuamano (Giffard); Kaholuamano. Waialeale trail, Waialae Falls (Kusche).

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* This figure was later designated as *P. giffardi* (Proc. Haw. Ent. Soc., IV, p. 495, 1921).

Plagithmysus arachnipes Sharp.
Sharp, Ent. Mo. Mag., (2), VII, p. 274, 1896.
Sharp, Fauna Hawaiiensis, II, p. 112, Pl. VI, fig. 20, 1900.

KAUAI. Collected on *Acacia koa* by Perkins; Kauai, 4,000 feet (Kusche). Bred from koa at Halemanu by Swezey, July, 1932.

Plagithmysus albertisi Sharp.
Sharp, Ent. Mo. Mag., (2), VIII, p. 12, 1897.
Sharp, Fauna Hawaiiensis, II, p. 110, Pl. VI, fig. 18, 1900.

West Honolulu, OAHU. Collected by Signor d'Albertis, 1874. Host tree not known.

Plagithmysus permundus Sharp.
Sharp, Fauna Hawaiiensis, II, p. 105, 1900.

KAUAI, 2,000 ft. Collected by Perkins on ahakea (*Bobea elatior*).

Plagithmysus diana Sharp.
Sharp, Fauna Hawaiiensis, II, p. 107, Pl. VI, fig. 11, 1900.

KAUAI, 4,000 ft. Collected by Perkins on *Pelea* sp.

Plagithmysus collaris Sharp.
Sharp, Fauna Hawaiiensis, II, p. 107, Pl. VI, fig. 13, 1900.

Haleakala, MAUI. Bred by Perkins from *Pelea* sp.

Plagithmysus lamarckianus Sharp.
Sharp, Fauna Hawaiiensis, II, p. 110, 1900.

Kilauea, HAWAII. Attached to *Pipturus albidus* and *Urera sandwicensis* (Perkins); collected on Pipturus by Giffard; bred from Pipturus at Paauilo, Hawaii, by Williams; bred from Pipturus at Upper Hamakua Ditch trail, Kohala Mts., Hawaii, by Swezey.

Plagithmysus munroi Sharp.
Sharp, Fauna Hawaiiensis, II, p. 112, Pl. VI, fig. 19, 1900.

Waimea, 2,000 ft., KAUAI (Munro). Collected on ohia lehua by Osborn at Kokee, Kauai; Kaholuamano, Waialeale trail, Waialae Falls (Kusche). Collected in pupal cell in *Sideroxylon sandwicense* at Kumuwela by Swezey, June, 1932.

Plagithmysus giffardi Perkins.
Perkins, Proc. Haw. Ent. Soc., I, p. 96, 1907.

Kilauea, HAWAII. Collected on *Suttonia lessertiana* by Perkins and Giffard; bred from *Smilax sandwicensis* by Swezey in 1929.

Plagithmysus fractus Perkins.
Perkins, Fauna Hawaiiensis, III, p. 646, 1910.

MOLOKAI. Fragments collected by Perkins. Host tree not known.

Plagithmysus elegans Sharp.
Sharp, Fauna Hawaiiensis, III, p. 648, 1910.

North Kona, HAWAII (Perkins). Host tree not known

Plagithmysus simplicicollis Sharp.
Sharp, Fauna Hawaiiensis, III, p. 648, 1910.

North Kona, HAWAII (Perkins). Host tree not known.

Plagithmysus kuhnsi Perkins.
Perkins, Proc. Haw. Ent. Soc., III, p. 248, 1916.

Waianae Mts., OAHU (Kuhns). Bred from *Pipturus albidus*, Haleauau Valley, Waianae Mts., Oahu by Swezey, 1927, 1928 and 1932.

Plagithmysus ignotus Perkins.
Perkins, Proc. Haw. Ent. Soc., III, p. 249, 1916.

KAUAI, 3,000 ft. (Munro). Kaholuamano, Kauai (Giffard); Waialae Falls (Kusche). Host tree not known.

Plagithmysus swezeyi Perkins.
Perkins, Proc. Haw. Ent. Soc., IV, p. 344, 1920.

Niulii, HAWAII (Swezey). Host tree not known.

Plagithmysus platydesmae Perkins.
Perkins, Proc. Haw. Ent. Soc., IV, p. 345, 1920.

Glenwood, HAWAII. Bred by Swezey from *Platydesma campanulata*.

Plagithmysus frater Perkins.
Perkins, Proc. Haw. Ent. Soc., IV, p. 500, 1921.

North Kona, HAWAII, 3,000 ft. Collected on *Pelea* sp. by Perkins.

Plagithmysus decorus Perkins.
Perkins, Proc. Haw. Ent. Soc., IV, p. 500, 1921.

Kilauea, HAWAII (Giffard). Host tree not known.

Plagithmysus nihoae Perkins.
Perkins, Tanager Expedition, No. 3, Bull. 31, B. P. Bishop Museum, p. 53, 1926.

NIHOA. Collected on Euphorbia by Bryan.

Plagithmysus forbesii Perkins.
Perkins, Proc. Haw. Ent. Soc., VI, p. 471, 1927.

Alakai Swamp, KAUAI (Forbes). Host tree not known.

Plagithmysus paludis Perkins.
Perkins, Proc. Haw. Ent. Soc., VI, p. 472, 1927.

Alakai Swamp, KAUAI (Forbes). Host tree not known.

Plagithmysus kohalae Perkins.
Perkins, Proc. Haw. Ent. Soc. VI, p. 473, 1927.

Upper Hamakua Ditch trail, Kohala Mts., HAWAII (Swezey). Host tree not known.

Plagithmysus longicollis Perkins.
Perkins, Proc. Haw. Ent. Soc., VI, p. 474, 1927.

Halehaku, MAUI (Bryan). Host tree not known.

Plagithmysus sharpianus Perkins.
Perkins, Proc. Haw. Ent. Soc., VI, p. 475, 1927.

Kumuwela, KAUAI (Swezey). Bred from *Pipturus albidus*.

Plagithmysus molokaiensis Perkins.
Perkins, Proc. Haw. Ent. Soc., VI, p. 475, 1927.

Kamiloloa, 3,200 ft., MOLOKAI (Swezey). Bred from *Pipturus albidus*.

Plagithmysus muiri Perkins.
Perkins, Proc. Haw. Ent. Soc., VI, p. 476, 1927.

Haleauau Valley, Waianae Mts., OAHU (Swezey and Williams). Bred from *Sideroxylon sandwicense*.

Plagithmysus rubi Perkins.
Perkins, Proc. Haw. Ent. Soc., VII, p. 415, 1931.

Olinda, MAUI. Bred from *Rubus hawaiiensis* by Swezey.

Plagithmysus simillimus Perkins.
Perkins, Proc. Haw. Ent. Soc., VII, p. 415, 1931.

Kula Pipe Line trail, Olinda, MAUI. Bred from *Pipturus albidus* by Swezey.

From the above, it will be seen that there are 14 species of Plagithmysus whose host trees have not yet been determined. Twelve of these are uniques, as follows: *newelli, lanaiensis, speculifer, fractus, elegans, ignotus, swezeyi, decorus, forbesii, paludis, kohalae* and *longicollis*; besides all of these, the host tree is unknown for *albertisi* and *simplicicollis*. All of which shows that there is yet much to learn about the Plagithmysus group.

Nesithmysus bridwelli Perkins.
Perkins, Proc. Haw. Ent. Soc., VI, p. 343, 1920.

Mt. Kaala, 3,000 ft., OAHU (Swezey and Bridwell). The two first specimens were collected on ohia lehua and Broussaisia. Bred from *Pelea sandwicensis, Pelea clusiaefolia* and possibly other species of Pelea, on Kaala, 1930; Kahana at summit, 1931; and Waipio Ridge, 1928, by Swezey.

Nesithmysus forbesii Perkins.
Perkins, Proc. Haw. Ent. Soc., IV, p. 503, 1921.

Haipuaena, 3,100 ft., MAUI. Collected on *Pelea* sp. by Forbes. Bred from *Pelea* sp. on the Kula Pipe Line trail, Olinda, Maui, by Swezey, 1927.

Nesithmysus haasii Perkins.
Perkins, Proc. Haw. Ent. Soc., IV, p. 504, 1927.

Wahiawa, 2,000 ft., OAHU (Haas). Bred from *Pelea* sp. at Kahana summit by Swezey, 1931.

Nesithmysus swezeyi Perkins.
Perkins, Proc. Haw. Ent. Soc., VI, p. 485, 1927.

Kula Pipe Line trail, Olinda, MAUI. Bred from *Pelea* sp. by Swezey, 1927.

All of these species of Nesithmysus are detrimental to their host trees. The larvae live in the living tree, either boring down the terminal twigs or branches, or else boring in the heart of living tree trunks and branches.

Aeschrithmysus terryi Perkins.
Perkins, Proc. Haw. Ent. Soc., VII, p. 261, 1929.

Haleakala Crater, MAUI (Degener). Adults and larvae found in stems of silversword (*Argyroxiphium sandwicense macrocephalum*).

Aeschrithmysus swezeyi Perkins.

Perkins, Proc. Haw. Ent. Soc., VII, p. 262, 1929.

Summit of Haleakala, MAUI (Swezey and Whitten). Collected from *Raillardia ciliolata*; larvae also found boring in the stems.

Callithmysus microgaster (Sharp).

Clytarlus microgaster Sharp, Trans. Ent. Soc., London, p. 103, 1879.
Callithmysus microgaster Sharp, Fauna Hawaiiensis, II, p. 113, 1900; III, p. 649, 1910.

Mts. near Honolulu, OAHU (Blackburn); Oahu (Koebele); N. W. Koolau Range and Tantalus (Perkins); Pupukea (Swezey); Waikane (Swezey and Hadden). Collected on *Bobea elatior* and the larvae found in the same tree by Perkins; bred from *Bobea elatior* by Swezey and Hadden, 1930.

Callithmysus microgaster var. (?) **hirtipes** Sharp.

Sharp, Fauna Hawaiiensis, II, p. 113, 1900.

Kaumuahona, OAHU. Collected by Perkins on *Bobea* sp.*; bred from *Perrottetia sandwicensis* in the same locality by Swezey, 1919.

Callithmysus koebelei Perkins.

Perkins, Proc. Haw. Ent. Soc., I, p. 210, fig., 1908.

Tantalus, OAHU. Bred from *Pipturus albidus* by Koebele, Perkins, Swezey and Bridwell; bred from the same tree, Kaipapau valley by Swezey, 1928.

Neoclytarlus modestus (Sharp).

Clytarlus modestus Sharp, Trans. Ent. Soc., London, p. 104, 1879.
Clytarlus modestus Sharp, Fauna Hawaiiensis, II, p. 101, 1900.
Neoclytarlus modestus, Timberlake, Proc. Haw. Ent. Soc., V, p. 17, 1922.

Haleakala, 4,000-5,000 ft., MAUI (Blackburn, Perkins, Giffard, Fullaway, Swezey). Host tree: *Acacia koa*.

Neoclytarlus pennatus (Sharp).

Clytarlus pennatus Sharp, Trans. Ent. Soc., London, p. 532, 1881.
Clytarlus pennatus Sharp, Fauna Hawaiiensis, II, p. 102, Pl. VI, figs. 2, 3, 1900.
Neoclytarlus pennatus, Swezey, Proc. Haw. Ent. Soc., VI, p. 198, 1925.

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* Later, Dr. Perkins has stated that this was not a positive identification of the tree from which a single beetle was taken. (Proc. Haw. Ent. Soc., IV, p. 502, 1921).

Haleakala, 5,000 ft., MAUI (Blackburn, Perkins, Giffard, Fullaway, Swezey). Host tree: *Acacia koa.*

Neoclytarlus fragilis (Sharp).

Clytarlus fragilis Sharp, Trans. Ent. Soc., London, p. 534, 1881.
Clytarlus fragilis Sharp, Fauna Hawaiiensis, II, p. 99, 1900.
Neoclytarlus fragilis, Bridwell, Proc. Haw. Ent. Soc., IV, p. 323, 1920.

Palolo Valley, OAHU (Blackburn, Perkins); Waianae Mts., Tantalus (Perkins); Fort Shafter Ridge (Swezey). Host tree: *Acacia koa.*

Neoclytarlus filipes (Sharp).

Clytarlus filipes Sharp, Trans. Dublin Soc., (2), III, p. 196, 1885.
Clytarlus filipes Sharp, Fauna Hawaiiensis, II, p. 99, 1900.
Neoclytarlus filipes, Perkins, Proc. Haw. Ent. Soc., VII, p. 382, 1931.

Mauna Loa, HAWAII (Blackburn)); Kona, Kau, Kilauea (Perkins); Huehue (Swezey). Attached to *Sophora chrysophylla.* Reared from *Maba sandwicensis* at Puuwaawaa Ranch, Hawaii, August, 1929 (Williams).

Neoclytarlus mediocris (Sharp).

Clytarlus mediocris Sharp, Fauna Hawaiiensis, II, p. 99, Pl. VI, figs. 1, 1b, 1900.
Neoclytarlus mediocris, Perkins, Proc. Haw. Ent. Soc., VI, p. 485, 1927.

Haleakala, 3,000-5,000 ft., MAUI (Perkins). Attached to *Sophora chrysophylla.*

Neoclytarlus debilis (Sharp).

Clytarlus debilis Sharp, Fauna Hawaiiensis, II, p. 99, 1900.
Neoclytarlus debilis, Swezey, Proc. Haw. Ent. Soc., VI, p. 198, 1925.

Mauna Loa, 4,000 ft., Hualalai, 5,000 ft., HAWAII (Perkins); South Kona (Swezey). Host tree: *Acacia koa.*

Neoclytarlus obscurus (Sharp).

Clytarlus obscurus Sharp, Fauna Hawaiiensis, II, p. 100, 1900.
Neoclytarlus obscurus, Perkins, Proc. Haw. Ent. Soc., VI, p. 485, 1927.

Various localities, 3,000 ft., KAUAI (Perkins); Kaholuamano (Kusche). Host tree: *Acacia koa.*

Neoclytarlus claviger (Sharp).

Clytarlus claviger Sharp, Fauna Hawaiiensis, II, p. 101, 1900.
Neoclytarlus claviger, Swezey, Proc. Haw. Ent. Soc., VI, p. 198, 1925.

Kilauea, HAWAII (Perkins). Host tree: *Acacia koa.*

Neoclytarlus laticollis (Sharp)

Clytarlus laticollis Sharp, Fauna Hawaiiensis, II, p. 101, 1900.
Neoclytarlus laticollis, Swezey, Proc. Haw. Ent. Soc., VI, p. 198, 1925.

Haleakala, 5,000 ft., MAUI (Perkins). Host tree: *Acacia koa*.

Neoclytarlus abnormis (Sharp).

Clytarlus abnormis Sharp, Fauna Hawaiiensis, II, p. 102, 1900.
Neoclytarlus abnormis, Perkins, Proc. Haw. Ent. Soc., VI, p. 481, 1927.

Olaa, HAWAII (Perkins). Probably attached to Metrosideros or Straussia.

Neoclytarlus nodifer (Sharp).

Clytarlus nodifer Sharp, Fauna Hawaiiensis, II, p. 102, 1900.
Neoclytarlus nodifer, Perkins, Proc. Haw. Ent. Soc., VI, p. 485, 1927.

Kona, 3,000 ft., HAWAII (Perkins); Puuwaawaa (Giffard); Humuula (Meinecke); Judd Trail, Kona (Swezey). Host tree: *Acacia koa*.

Neoclytarlus longipes (Sharp)

Clytarlus longipes Sharp, Fauna Hawaiiensis, II, p. 103, Pl. VI, fig. 4, 1900.
Neoclytarlus longipes, Swezey, Proc. Haw. Ent. Soc., VI, p. 198, 1925.

KAUAI (Perkins); Kaholuamano (Kusche). Host tree: *Acacia koa*. Bred from *Alphitonia excelsa* at Halemanu by Swezey, June, 1932.

Neoclytarlus annectens (Sharp).

Clytarlus annectens Sharp, Fauna Hawaiiensis, II, p. 104, 1900.
Neoclytarlus annectens, Swezey, Proc. Haw. Ent. Soc., VI, p. 198, 1925.

KAUAI (Perkins); 3,500-4,000 ft., Kauai (Kusche). Host tree: *Acacia koa*.

Neoclytarlus ultimus (Sharp).

Clytarlus ultimus Sharp, Fauna Hawaiiensis, III, p. 645, 1910.
Neoclytarlus ultimus, Perkins, Proc. Haw. Ent. Soc., VI, p. 485, 1927.

Tantalus, Pauoa, OAHU (Koebele, Perkins). Host tree: *Acacia koa*.

Neoclytarlus immundus (Sharp).

Plagithmysus immundus Sharp, Fauna Hawaiiensis, III. p. 646, 1910.
Neoclytarlus immundus, Perkins, (in letter, Jan. 9, 1927), Proc. Haw. Ent. Soc., VII, p. 16, 1928.

North Kona, HAWAII (Perkins, Giffard). Host tree not known.

Neoclytarlus indecens (Perkins).
Clytarlus indecens Perkins, Proc. Haw. Ent. Soc., IV, p. 346, 1920.
Neoclytarlus indecens, Bridwell, Proc. Haw. Ent. Soc., IV, p. 454, 1921.

Mt. Kaala, OAHU, September 7, 1913 (Osborn). Bred from *Smilax sandwicensis*, Mt. Kaala, July 9, 1916 (Swezey); Kaala, 1919, 1920 (Bridwell); Kahana, 1927, Waipio Ridge, 1929 (Swezey).

Neoclytarlus indecens var. **kinaluensis** Perkins.
Perkins, Proc. Haw. Ent. Soc., VII, p. 418, 1931.

Kainalu, 2,000 ft., MOLOKAI. Bred by Swezey from *Smilax sandwicensis*.

Neoclytarlus euphorbiae Bridwell.
Bridwell, Proc. Haw. Ent. Soc., IV, p. 323, 1920.

Ewa Coral Plain, OAHU (Bridwell, Swezey, Bryan). A large series bred from stems of *Euphorbia multiformis*.

Neoclytarlus pulchrior Perkins.
Perkins, Proc. Haw. Ent. Soc., VI, p. 482, 1927.

A single specimen known. It was found unlabelled among some miscellaneous specimens; hence, collector, locality and host plant are not known.

Neoclytarlus fugitivus Perkins.
Perkins, Proc. Haw. Ent. Soc., VI, p. 483, 1927.

Haleakala, 4,500 ft., MAUI. One specimen collected January 14, 1926, along the Kula Pipe Line trail by Swezey. Host plant not known.

Neoclytarlus smilacis Perkins.
Perkins, Proc. Haw. Ent. Soc., VI, p. 484, 1927.

Waikamoi, 4,500 ft., MAUI. Bred by Swezey from larvae in stems of *Smilax sandwicensis*, Jan., Feb., 1926.

Neoclytarlus raillardiae Perkins.
Perkins, Proc. Haw. Ent. Soc., VII, p. 416, 1931.

Summit of Haleakala, MAUI. A dozen collected by Swezey, June 17, 1927, from clumps of half-dead *Raillardia ciliolata* bushes, and larvae also found in dead stems.

Neoclytarius geranii Perkins.
Perkins, Proc. Haw. Ent. Soc., VII, p. 417, 1931.

Haleakala, 6,000 ft., MAUI. Beetles collected by Swezey, June 15, 1927, from clumps of *Geranium trifida,* and larval burrows and exit holes found in dead stems.

Paraclytarius timberlakei Perkins.
Perkins, Proc. Haw. Ent. Soc., VI, p. 480, 1927.

Mt. Olympus, OAHU. A single specimen collected on ohia lehua by Timberlake in 1916.

Paraclytarius pipturicola Perkins.
Perkins, Proc. Haw. Ent. Soc., VI, p. 481, 1927.

Kailua, MAUI. A single specimen collected June 14, 1920, by Bryan on *Pipturus albidus.*

Paraclytarius podagricus Perkins.
Perkins, Proc. Haw. Ent. Soc., VI, p. 482, 1927.

Upper Hamakua Ditch trail, Kohala Mts., HAWAII. A single specimen collected by Swezey September 2, 1919. Host tree not known.

FREDERICK A. G. MUIR

Biographical Sketch
The Work of Dr. Frederick A. G. Muir in the Biological Control of Sugar Cane Insects in Hawaii

BY O. H. SWEZEY AND F. X. WILLIAMS

(Presented at the meeting of June 4, 1931)

With the death of Dr. Muir in England on May 13, 1931, ended the career of a man who had devoted his best years to the field of biological control as a method of controlling insect pests. Dr. Muir began this work for the Experiment Station of the Hawaiian Sugar Planters' Association in September, 1905. This was when the sugar cane leafhopper (*Perkinsiella saccharicida* Kirk.) was still a serious pest in Hawaii. It was also shortly after the introduction of the leafhopper egg-parasites* by Albert Koebele and Dr. R. C. L. Perkins, from Australia and Fiji. These parasites had not yet shown their ability to cope with the enormous numbers of their host. Mr. Koebele had been working for more than ten years on the introduction of beneficial insects into Hawaii and, being in failing health, wished to retire from active foreign work in the tropics. On his return from Fiji he spent but a short time in Honolulu in the summer of 1905, before leaving for California. Mr. Koebele never came to Honolulu again.

To carry on the work in which Mr. Koebele had been so successful since his arrival in Hawaii in 1893, Dr. Muir was engaged, and his services on the staff of the Experiment Station, H.S.P.A., commenced September 1, 1905.

Spending but a short time in Honolulu, Dr. Muir's first foreign trip was to Fiji with the primary object of investigating the economic conditions of the leafhopper in cane fields there. This leafhopper was a different species from the cane leafhopper in Hawaii and was found doing no damage to cane, being kept in check by several natural enemies, the most important of which were the egg-parasites mentioned above and which had already been introduced into Hawaii. Another parasite found to have economic value was a stylopid (*Elenchus tenuicornis* Perk.). Attempts were made to introduce this parasite into Hawaii, but it

* *Paranagrus optabilis* Perk., *P. perforator* Perk., and *Anagrus frequens* Perk., from Australia in 1904; and *Ootetrastichus beatus* Perk. from Fiji in 1905.

failed to attack the leafhopper in the cane fields there. Still another parasite found was a dryinid (*Haplogonatopus vitiensis* Perk.) which was successfully introduced into Hawaiian cane fields, and for a time was quite a factor in the control of the leafhopper. After a number of years, however, it became scarce and in recent years has been seldom seen.

On this trip a great deal of time was spent in investigating the cane borer (*Rhabdocnemis obscura* [Boisd.]) to discover if possible the cause of its decrease there, for Mr. Koebele had reported such a decrease in Fiji since his visit there in 1892. No natural enemies were found that could be considered responsible for this. Some of the planters believed that the introduction of a harder variety of cane was the chief reason for the decrease of the borer. After six months in Fiji, Dr. Muir returned to Honolulu, where a few months were spent prior to starting off in July, 1906, for the Orient, where cane leafhopper parasites were investigated in south China in the vicinity of Macao, and inland from Canton. Cane leafhoppers there were found well controlled by egg-parasites similar to those in Australia and Fiji, and there were other valuable enemies as well. Only one of these was successfully introduced into Hawaii. This was a large black dryinid (*Pseudogonatopus hospes* Perk.), parasitic on adult leafhoppers. It was reared at the Experiment Station and colonies were distributed to the other islands, but it was only after nine years that it was known to have become established in Hawaiian cane fields. It never became very numerous, but even in recent years with the leafhopper usually scarce, this parasite maintains its existence, and an occasional parasitized leafhopper is to be found usually wherever any leafhoppers occur.

In February a brief visit was made to the Federated Malay States where conditions as regards leafhoppers and their enemies were found to be about as in China. A search was begun for the cane borer beetle, which was continued in Java; Dr. Muir arrived at Batavia on March 10th and spent several months in the different sugar cane sections of Java, without finding any evidence of our cane borer beetle, or any direct parasites on related beetles in banana and palm trees.

On July 21, he left Java for a few weeks' search for the borer in Borneo, returning to Batavia in September, from which place

another start was made in October, 1907. The search for the natural home of the beetle borer was continued in Amboina and Larat, where at last this insect was found in sago and pinang palms and in sugar cane. No success was had in finding parasites for several months, however. Finally, in January, 1908, a tachinid fly* was found attacking the grubs or larvae of this borer. Eight months were then spent at Amboina in studying this parasite and breeding it for shipment to Honolulu; but as the parasite could not survive such a long journey, attempts were made to establish a relay station at Hongkong. This station, which was to have been conducted by F. W. Terry, was not successful as the tachinids always died en route. Finally, Dr. Muir tried taking living material with him to Hongkong, but the flies all died the day before his arrival. This venture having failed, Dr. Muir left Hongkong in November, 1908, for further explorations, visiting Ceram and Makassar, en route to New Guinea, where he landed at Port Moresby in April, 1909. Here for the first time, the tachinid parasite, that was breeding so well on the borer grubs in palm trees at Amboina, was found attacking a high percentage of the borer grubs in sugar cane. At once preparations were made for stocking cages with borer-infested cane in which the borers were to be parasitized, and then brought to Honolulu. Several months were required for this, and when eventually the cages were in readiness for the long journey, Dr. Muir fell ill with typhoid fever just prior to leaving Port Moresby, New Guinea, so that on arriving at Brisbane, Queensland, he was compelled to go to a hospital where he remained for five weeks. His cages were forwarded to Honolulu, arriving there September 15, 1909. Over 200 of the tachinid flies had matured en route, but, lacking the personal care that had been planned for them, all had died before their arrival in Honolulu. Thus is recorded another failure in the introduction of this parasite.

As soon as he had recovered sufficiently in the Brisbane hospital, Dr. Muir came on to Honolulu for further recuperation, arriving about the end of October, after an absence from Honolulu of three years and three months, most of which time was spent in tropical jungles where he was exposed to the dangers from wild animals, venomous snakes and insects, as well as to tropical diseases prevalent in those regions.

*_Ceromasia sphenophori_ Vill.

At once plans were made for further attempts to introduce this parasite on the cane borer. Dr. Muir left Honolulu, January 8, 1910, on the final endeavor which resulted in the transportation of the living parasite to Honolulu and its establishment in the cane fields of Hawaii. The procedure this time was the establishing of a relay breeding station at Mossman, Queensland, cared for by Mr. J. C. Kershaw. In cages here the tachinid was bred from material brought by Dr. Muir from New Guinea. Of the first generation of parasites reared in these cages, a portion was taken in the puparium stage to Fiji, where at Nausori another relay breeding station was established. From the next generation of parasites produced here, living material was brought to Honolulu by Dr. Muir on August 16, 1910. Mr. Kershaw arrived a month later with more material reared in Fiji. From both of these lots there were sufficient adult parasites to allow some to be liberated in a few cane fields, while others were retained for breeding in cages. Altogether, over four years were occupied on this project; from the beginning until living parasites were landed in Honolulu. The results obtained in checking the cane borer after the parasite was established and fully distributed, more than justified the time, effort and expense involved.

Staying a short time, until the breeding of the tachinid was well started, Dr. Muir sailed from Honolulu, October 4, 1910, for a well-earned leave, going to England for a year, and returning to Honolulu, October 11, 1911.

The next large project undertaken by Dr. Muir, was the endeavor to find and introduce natural enemies of the cane root grub, *Anomala orientalis* (Waterhouse), which in 1912 was found established in cane fields in the Pearl Harbor district of Oahu. There was little or no encouragement to be had from previous efforts to control root grubs by natural enemies in other parts of the world. However, after duly considering the situation, Dr. Muir believed that an attempt should be made to control the spread of Anomala in our cane fields by this method. He left Honolulu for Japan, March 28, 1913, that country being the home of *Anomala orientalis*. A number of valuable natural enemies were found working on Anomala there and efforts were made to introduce some of them here, but none ever became established. After about a year in Japan, search was made in Java, Formosa

and the Philippines for parasites of closely related species of root grubs that might possibly be utilized against Anomala. The breaking out of the World War disturbed transportation from those regions, and it was found that the Philippines were the most favorable place in which to work and to secure dependable transportation for consignments of parasites. A large number of root-grub enemies were studied in the Philippines, headquarters being established at the College of Agriculture at Los Banos, where every facility for the work was rendered. Dr. Muir was assisted in the work here by Mr. H. T. Osborn and Dr. F. X. Williams, and large quantities of some of the parasites were reared for shipment to Honolulu, and many consignments were made during 1915, 1916 and 1917.

Of the numerous parasites of several kinds that were handled, *Scolia manilae* Ashmead, the wasp which parasitizes the Anomala grub was the only one to become established in our cane fields. It was first found established and breeding on Anomala grubs September 16, 1916. In the four years since its discovery, Anomala had spread over a considerable area of cane land adjacent to Pearl Harbor. As soon as Scolia was found established in one field, assistance was given it in spreading throughout the Anomala-infested area. This was accomplished during the next year, and the wasp proved so efficient that attempts to introduce additional parasites on Anomala were discontinued. This project turned out to be the first successful control of a root grub by means of natural enemies.

During the four years involved in this work, Dr. Muir returned to Honolulu once or twice; on one trip, coming via Formosa, he brought some leafhopper egg-parasites, one of which (*Ootetrastichus formosanus* Timberlake) became established and spread throughout the cane fields of the islands and was an additional factor in the control of the sugar cane leafhopper. It persists to the present time, even where the leafhopper is normally scarce.

On October 31, 1917, Dr. Muir left for England to engage in war service for his native country in the trying days of the World War. He returned to Honolulu a year later on October 28, 1918. In the meantime he had married Margaret Annie Sharp on April 9, 1918, the daughter of Dr. David Sharp, the noted entomologist

who contributed much to the study of Hawaiian insects and to the Fauna Hawaiiensis. Mrs. Muir accompanied Dr. Muir on his return from England, and also on his last trip in search of parasites to Australia, which was begun early the next year.

Although there now existed a fairly satisfactory control of the sugar cane leafhopper by the introduced parasites previously mentioned, nevertheless in a few plantations there were recurrences of leafhopper outbreaks which were of considerable importance. The purpose of Dr. Muir's last trip May 18, 1919, to June 21, 1920, was to endeavor to find what additional factors controlled the leafhopper in the Queensland cane fields. After considerable research, he found that a small bug, *Cyrtorhinus mundulus* (Breddin), of the family Miridae, lived by sucking the contents of the eggs of the leafhopper. The introduction of this bug into Hawaii was soon accomplished, chiefly from Fiji (where it was known to occur), by Mr. C. E. Pemberton the following year, September to November, 1920. This bug was reared and colonies distributed for a year, and from thereafter when it became thoroughly established, the control of the leafhopper pest in Hawaiian cane fields was practically complete. There have been slight outbreaks occasionally, but the Cyrtorhinus bug was always prompt to find them, and would soon increase to numbers sufficient to regain control. It has been thought that if this bug had been the only leafhopper enemy introduced it might of itself have been able to sufficiently control the leafhopper.

The total results of the major introductions above enumerated have been the saving of millions of dollars to the sugar industry in Hawaii, and the comparative freedom from destructive insect pests in the cane fields.

After returning from the last trip to Australia, Dr. Muir established his home in Honolulu. Much of his time was now devoted to systematic studies in Homoptera, particularly the Fulgoroidea. This is the group which contains the family Delphacidae to which the cane leafhopper belongs. In his travels Dr. Muir made a specialty of studying and collecting sugar cane leafhoppers as well as other related leafhoppers. Many species of these were named and described by him in numerous papers included in the bibliography which follows. He became intensely interested also in the leafhoppers of the forests of Hawaii, and

added many species to those already known, these new species of the Hawaiian fauna being published in the Proceedings of the Hawaiian Entomological Society. Dr. Muir eventually devoted himself to the study of leafhoppers the world over, and was recognized as a world authority on the leafhoppers of the family Delphacidae. Just before his death he was planning to work up a large collection from South America.

Dr. Muir's health had been undermined by so much time spent in unhealthful tropical jungles, etc., and he went to England at intervals, spending most of the years 1927 and 1928 there. On his return from England, September 12, 1928, arrangements were made for his retirement from active service at the Experiment Station, H.S.P.A. He left Honolulu on November 17, 1928, to make his home in England, and had made preparations for carrying on systematic work there in his favorite family of leafhoppers, which work, however, he was not able to pursue because of his failing health.

PUBLISHED WRITINGS OF DR. F. A. G. MUIR

In the Hawaiian Planters' Monthly and Hawaiian Planters' Record.

1908. Report of travels in Borneo in search of cane borer parasites. Planters' Monthly, XXVII, pp. 50-57.

1908. Report on the search for the sugar cane borer in the Malay Archipelago. XXVII, pp. 252-257.

1909. Report on the sugar cane borer in the Moluccas. Planters' Record, I, pp. 40-48, 1 map.

1909. Concluding report on travels in the Malay Archipelago in search of parasites for the cane borer. I, pp. 256-261.

1910. Report on second trip to British New Guinea to obtain a tachinid fly, parastic on the sugar cane beetle borer. III, pp. 186-200, 5 pls.

1914. Observations in Formosa. X, pp. 274-281.

1915. The relation of the parasite to its host. XIII, pp. 118-125, 1 diagram.

1917. Remarks on leaf-hopper outbreaks. XVII, pp. 227-230.

1919. The use of insecticides against leaf-hoppers. XX, pp. 171-172.

1919. Leaf-hopper infestation in plant cane. XX, pp. 380-381.

1920. Report of entomological work in Australia, 1919-1920. XXIII, pp. 125-130, 1 fig.

1920. The "Japanese" beetle is Chinese. XXIII, p. 291.

1921. Cyrtorhinus in Hawaii and some factors acting against it. XXIV, pp. 285-286.

1921. The fern weevil in Australia. XXV, pp. 2-3.

1922. Direct and indirect injury to plants by insects. XXVI, pp. 65-66.

1922. Earthworms and their culture in relation to agriculture. XXVI, pp. 159-163.

1931. The biological control of the coconut moth (*Levuana iridescens* Beth.-Baker) in Fiji. XXXV, pp. 85-87.

Co-authorship

Muir, F., and Henderson, G. 1926. Nematodes in connection with sugar cane Root Rot in the Hawaiian Islands. XXX, pp. 233-250, 14 figs.
Muir, F., Henderson, G. and Van Zwaluwenburg, R. H. 1927. A generic list of the spear-bearing nematodes with a revised dichotomous table. XXXI, pp. 354-361.
Muir, F., and Swezey, O. H. 1926. Entomologists' Report on Termite Problem. XXX, pp. 331-335.
Muir, F., and Van Zwaluwenburg, R. H. 1927. The bad effect of leaf pruning upon the growth of stalk and root of sugar cane. XXXI, pp. 110-112, 2 figs.
Stewart, G., Muir, F., Van Zwaluwenburg, R. H., Cassidy, G. H., and Hansson, F., 1928. The relation between soil treatments and nematode attacks to cane roots in central Maui soils. XXXII, pp. 205-217.

As Bulletins or Circulars of the Experiment Station, Department of Entomology, Hawaiian Sugar Planters' Association

1906. Notes on Some Fijian Insects. Bull. 2, pp. 1-11, 1 pl.
1907. Report on Investigations in South China. Circular No. 1, pp. 1-11.
1907. Notes on the Sugar-Cane Hoppers and Borers in the Malay States and Java. Circular No. 2, pp. 1-13.
1908. Entomological Work in Borneo. Circular No. 4, pp. 1-12.
1910. On Some New Species of Leafhopper (*Perkinsiella*) on Sugar Cane. Bull. No. 9, pp. 1-11, 5 figs.
1926. Contributions to our Knowledge of South American Fulgoroidea (Homoptera) Part I, The Family Delphacidae. Bull. 18, 51 pp., 5 pls.
1931. The Insects and Other Invertebrates that occur in Hawaiian Sugar Cane Fields. Introduction. pp. 11-32.

Co-authorship

Kirkaldy, G. W., and Muir, F. 1913. On Some New Species of Leafhoppers. (Part I *Cicadidae, Cercopidae* and *Fulgoridae* by Kirkaldy; Part II *Derbidae* by Muir). Bull. No. 12, pp. 28-92, 3 pls.
Muir, F., and Swezey, O. H. 1916. The Cane Borer Beetle in Hawaii and its Control by Natural Enemies. Bull. 13, pp. 1-51, 4 figs. and 4 pls.
Muir, F., and Giffard, W. M. 1924. Studies in North American Delphacidae. Bull. 15, 53 pp., 6 pls.

In the Proceedings of the Hawaiian Entomological Society

1908. On the stridulating organ of a sphingid from Larat. II, pp. 12-13.
1913. On an abnormal larva of *Lasiorhynchus barbicornis* (Fabr.). II, pp. 219-220.
1913. On some new Fulgoroidea. II, pp. 237-269, pl. 6.
1914. On some Derbidae from Formosa and Japan. III, pp. 42-52.
1914. Presidential address. III, pp. 28-42, 1 diagram.
1914. A Delphacid on bamboo in Formosa. III, p. 53.
1915. New and little known Derbidae. III, pp. 116-136, 3 pls.
1916. Review of the autochthonous genera of Hawaiian Delphacidae. III, pp. 168-221, Part II, biogenetic, pp. 197-221, 79 figs.
1917. New Hawaiian Delphacidae. III, pp. 298-311, 1 pl.
1917. Homopterous notes. III, pp. 311-338, 2 pls.
1918. Two new species of *Nesosydne*. III, pp. 405-407.
1918. Homopterous notes, II. Vol. III, pp. 414-428.

1919. New Hawaiian Delphacidae. IV, pp. 84-108, pls. III and IV, 4 figs.
1919. On the genus *Ilburnia* White (Homoptera, Delphacidae). IV, pp. 48-50.
1921. On some Delphacidae from South India (Homoptera). IV, pp. 480-486, 2 figs.
1921. New Hawaiian Delphacidae (Homoptera). IV, pp. 507-520, 1 pl.
1921. On some Samoan Fulgorids (Homoptera). IV, pp. 564-584, 1 pl.
1922. A new Hawaiian Delphacid (Homoptera). V, pp. 87-88, 2 figs.
1922. An interesting new Derbid Genus (Homoptera). V, pp. 89-90, 5 figs.
1922. New and little known Hawaiian Delphacidae (Homoptera). V, pp. 91-102, 1 pl.
1923. On the classification of the Fulgoroidea (Homoptera). V, pp. 205-247, 5 pls.
1924. New and little known Fulgorids from the West Indies (Homoptera). V, pp. 461-472, 1 pl.
1924. Homoplasmy, or Convergent Development in Evolution (Presidential address). V, pp. 473-483.
1925. On the Status of the Anterior Processes of the Male Genitalia in Homoptera. VI, pp. 41-45.
1926. Some Remarks on Dr. Hem-Singh-Pruthi's Paper on the Morphology of the Male Genitalia in Rhynchota. VI, pp. 323-334, 1 pl.
1926. *Atopocixius*, a New Genus of Uncertain Position in the Fulgoroidea (Hom.). VI, pp. 335-336, 1 pl.
1928. Some remarks on function as a base for classification and its relationship to form. VII, pp. 135-145.
1929. Parallelisms between the Insect Fauna of Hawaii and that of Samoa. VII, pp. 259-260.
1931. New and Little Known Fulgoroidea from South America, (Hom.). VII, pp. 469-479, 1 pl.

Published Outside the Territory of Hawaii

1907. Notes on the stridulating organ and stink-glands of *Tessaratoma papillosa*. Trans. Ent. Soc. London, pp. 256-258, 3 figs.
1909. Notes on the life-history of *Aulacodes simplicialis* Snell. Proc. Ent. Soc. London, XL-XLIV, 4 figs. (A letter to Prof. Poulton).
1912. Two new species of *Ascodipteron*. Bull. Mus. Comp. Zool. Harvard Coll. 54, pp. 349-366, pls. I-III.
1913. On the genus *Lamenia* Stål. Can. Ent., 45, p. 112.
1914. On the original habitat of *Stomoxys calcitrans*. Jour. Econ. Ent. 7, pp. 459-460.
1915. Notes on the ontogeny of the genital tubes in *Coleoptera*. Psyche, 22, pp. 147-152, pl. XII.
1915. A contribution towards the taxonomy of the Delphacidae. Can. Ent. 47, pp. 208-212, etc.
1916. A new Formosan *Purohita* (Delphacidae). Philip. Jour. Sci., 11, D, p. 311.
1916. Additions to the known Philippine Delphacidae. Philip. Jour. Sci., 11, D, pp. 369-385.
1917. The Derbidae of the Philippine Islands. Philip. Jour. Sci., 12, D, pp. 49-104, pl.
1917. A new genus of Derbidae from Borneo. Philip. Jour. Sci., 12, D, pp. 217-218.

1917. A new Philippine genus of Delphacidae. Philip. Jour. Sci., 12, D, pp. 217-218.
1917. The introduction of *Scolia manilae* Ashm. into the Hawaiian Islands. Ann. Ent. Soc. Amer. 10, p. 206-210.
1918. Notes on the ontogeny and morphology of the male genital tube in Coleoptera. Trans. Ent. Soc. London, pp. 223-229, pl. X.
1918. Pipunculidae and Stylopidae in Homoptera. Ent. Mo. Mag. 54, p. 137.
1918. Notes on the Derbidae in the British Museum. Ent. Mo. Mag. 54, pp. 173-177, 202-207.
1918. Notes on the Derbidae in the British Museum Collection II, Derbinae. Ent. Mo. Mag. 54, pp. 228-243.
1919. Some Malayan Delphacidae (Homoptera). Philip. Jour. Sci. 15, pp. 521-531, 1 pl.
1919. Notes on the Delphacidae in the British Museum Collection. Can. Ent., 51, pp. 6-8.
1919. Some new American Delphacidae. Can. Ent., 51, pp. 35-38.
1920. A new genus of Australian Delphacidae. Proc. Linn. Soc. N. S. Wales, 45, pp. 181-182.
1920. The male abdominal segments and aedeagus of *Habrocerus capillaricornis* Grav. (Coleoptera, Staphylinidae), Tr. Ent. Soc. London, 1919-1920, pp. 398-403, pl. XX.
1920. On the mechanism of the male genital tube in Coleoptera. Tr. Ent. Soc. London, 1919-1920, pp. 404-414, pl. XXI
1920. On some African Delphacidae (Homoptera). Bull. Ent. Res., 10, pp. 139-144.
1921. A symbiotic organism in Fulgorids. Psyche, 28, p. 59-60.
1921. On some recent remarks on the phylogeny of Homoptera. Psyche, 28, pp. 116-119.
1921. The male genitalia of *Merope tuber* Newm. (Mecoptera). Tr. Ent. Soc. London, pp. 231-232, 1 pl.
1922. On some Indian Derbidae (Homoptera). Rec. Ind. Mus. Calcutta, 24, pp. 335-342, 8 figs.
1922. New Indian Homoptera. Rec. Ind. Mus. Calcutta, 24, pp. 343-355, 4 figs.
1922. New Malayan Cixiidae (Homoptera). Philip, Jour. Sci. 20, pp. 111-120, 2 pls.
1922. Three new species of Derbidae (Homoptera). Philip. Jour. Sci. 20, pp. 347-349, 4 figs.
1922. A new genus of Australian Cixiidae (Homoptera). Proc. Linn. Soc. N.S.W. 47, pp. 63-64.
1922. On the genus *Elidiptera* Spin. (Homoptera). Can. Ent. 54, p. 61, 2 figs.
1923. On the homology between the genitalia of some species of Diptera and those of *Merope tuber*. Trans. Ent. Soc. London, pp. 176-180, 2 pls.
1923. New species of Fulgorids (Homoptera). Ann. Mag. Nat. Hist. (9), 11, pp. 553-560.
1923. On the characters separating Heteroptera from Homoptera. Ent. Mo. Mag. 59, p. 254.

1923. Two species of Delphacidae (Homoptera) from Kermadec Archipelago. Trans. N. Z. Inst. 54, p. 257.
1923. New species of New Zealand Delphacidae (Homoptera). Trans. N. Z. Inst. 54, pp. 258-259, 4 figs.
1923. A new species of *Derbe* Fabr. (Homoptera) Notulae Ent. Helsingfors, 3, p. 67.
1923. A new Philippine *Stenocranus* (Delphacidae, Homoptera). Philip. Jour. Sci. 22, pp. 157-159, 2 figs.
1923. The genus *Myndus* in the Malay States (Homoptera). Philip. Jour. Sci. 22, pp. 161-170, 1 pl.
1923. Two collections of Fulgoroidea from Sumatra. Philip. Jour. Sci. 22, pp. 171-178, 1 pl.
1923. *Achilixius*, a new genus constituting a new family of the Fulgoroidea (Homoptera). Philip. Jour. Sci. 22, pp. 483-487, 1 pl.
1924. An American Tettigometrid (Homoptera). Ann. Ent. Soc. Amer. 17, pp. 219-222, 6 figs.
1924. Notes on some genera of Derbidae (Homopt.). Proc. Ent. Soc. Wash. 26, pp. 15-19.
1924. A new genus of the family Achilixiidae (Homoptera). Can. Ent. 56, pp. 33-34, 1 fig.
1924. New Malayan species of *Oliarus* Stål, (Cixiidae, Homoptera). Philip. Jour. Sci. 24, pp. 509-527, 2 pls.
1924. On some new and little-known Australian Fulgoroidea (Homoptera). Mem. Queensland Mus. 8, pp. 29-36, 6 figs.
1924. On a new Cixiid attacking coconut palms (Homoptera). Bull. Ent. Res. 14, p. 456, 1 fig.
1925. The male genitalia of *Cupes concolor* Westw. (Coleoptera). Jour. New York Ent. Soc. 32, pp. 167-169, 1 pl.
1925. On the genera of Cixiidae, Meenoplidae and Kinnaridae (Fulgoroidea, Homoptera). Pan-Pacific Ent. 1, pp. 97-110, 156-163.
1925. On the genera *Amblycotis* Stål and *Bostaera* Ball (Delphacidae, Homoptera). Can. Ent. 57, p. 279.
1925. *Paraudes*, a new Cixiid genus (Homoptera, Fulgoroidea). Philip. Jour. Sci. 26, pp. 511-512, 2 figs.
1925. The genus *Andes* Stål (Cixiidae, Homoptera). Philip. Jour. Sci. 27, pp. 201-226, 2 pls.
1925. A new species of *Oliarus* from China (Fulgoroidea, Homoptera). Philip. Jour. Sci. 28, pp. 365-366, 1 fig.
1925. On some Fulgorids (Hemiptera-Homoptera) from the Island of Rodrigues. Trans. Ent. Soc. London, 1924-1925, pp. 463-474, 2 pls.
1925. Two new species of exotic Delphacidae (Homoptera). Ent. Mo. Mag. 61, pp. 221-222, 1 fig.
1926. Reconsideration of some points in the morphology of the head of Homoptera. Ann. Ent. Soc. Amer. 19, pp. 67-73, 1 fig.
1926. On some new and little-known Delphacidae from South Africa (Fulgoroidea, Homoptera). Ann. Mag. Nat. Hist. (9), 17, pp. 17-35, 37 figs.
1926. Notes on some African Derbidae (Homoptera). Ann. Mag. Nat. Hist., (9), 18, pp. 227-240, 18 figs.
1926. The morphology of the aedeagus in Delphacidae (Homoptera). Trans. Ent. Soc. London, 74, pp. 377-380, 2 pls.

1927. Insects of Samoa. Fulgoroidea. 2, Hemiptera, London, Br. Mus. (Nat. Hist.), pp. 1-27, 25 figs.
1927. New species of African Meenoplidae (Fulgoroidea, Homoptera). Ann. Mag. Nat. Hist., (9), 19, pp. 197-208, 20 figs.
1927. On some Fulgorids from the south Pacific. Ann. Mag. Nat. Hist., (9), 20, pp. 86-91, 7 figs.
1927. Remarks on the morphology of the male genitalia in Lepidoptera. Ent. Mo. Mag., 63, pp. 172-174.
1928. Notes on some African Derbidae (Homoptera), II. Ann. Mag. Nat. Hist., (10), 1, pp. 498-525, 38 figs.
1928. Spolia Mentawiensia, Fulgoroidea, Homoptera (Cixiidae, Meenoplidae, Delphacidae, Derbidae), Jour. Malayan Br. Asiat. Soc., 4, pp. 392-409, 34 figs.
1928. The evidence for hybrid vigour in insects. Nature, 121, p. 56.
1929. New and little-known South American Delphacidae (Homoptera, Fulgoroidea) in the collection of the British Museum. Ann. Mag. Nat. Hist., (10), 3, pp. 75-85, 22 figs.
1929. New and little-known African Delphacidae (Homoptera, Fulgoroidea) in the collection of the British Museum. Ann. Mag. Nat. Hist., (10), 4, pp. 186-222, 57 figs.
1929. The tentorium of Hemiptera considered from the point of view of the recent work of Snodgrass. Ent. Mo. Mag. 65, pp. 86-88.
1929. The role of function in Taxonomy and its relationship to the genitalia of insects. Trans. 4th. Internat. Congress Ent. Ithaca, Aug. 1928, Tring Herts 2, pp. 600-604.
1930. Three new species of American Cixiidae. Pan-Pacific Ent. 7, pp. 12-14, 4 figs.
1930. IV, New Derbidae from Sierra Leone (Homoptera, Fulgoroidea). Ann. Mag. Nat. Hist., (10), 5, pp. 81-84, 8 figs.
1930. Notes on certain points of morphology of the abdomen and genitalia of Psyllidae. Ann. Mag. Nat. Hist., (10), 5, pp. 545-552, 4 figs.
1931. New and little-known Fulgoroidea in the British Museum. Ann. Mag. Nat. Hist., (10), 7, pp. 297-314; 11 figs.

Co-authorship

1904. Muir, F., and Sharp, D. On the egg-cases and early stages of some Cassididae. Trans. Ent. Soc. London, pp. 1-24, pls. I-V (Coleoptera).
1912. The comparative anatomy of the male genital tube in Coleoptera. Trans. Ent. Soc., London, pp. 477-642, pls. XLII-LXXVIII.
1911. Muir, F., and Kershaw, J. C. On the homologies and mechanism of the mouth-parts of Hemiptera. Psyche, 18, pp. 1-12, 5 pls.
1911. Muir, F., and Kershaw, J. C. On the later embryological stages of the head of *Pristhesancus papuensis* (Reduviidae). Psyche, 18, pp. 75-79, pls. IX and X, (Heteroptera).
1912. Muir, F., and Kershaw, J. C. The development of the mouthparts in the Homoptera, with observations on the embryo of *Siphanta*. Psyche, 19, pp. 77-89, 14 figs.
1907. Kershaw, J. C., and Muir, F. On the egg-cases and early stages of some south China Cassididae. Trans. Ent. Soc. London, pp. 249-252.
1922. Kershaw, J. C., and Muir, F. The genitalia of the Auchenorhynchous Homoptera. Ann. Ent. Soc. Amer. 15, pp. 201-212, 1 pl.

Three New Parasitic Hymenoptera from the Indo-Malayan Region

BY P. H. TIMBERLAKE
Citrus Experiment Station, Riverside, Calif.
(Presented by O. H. Swezey at the meeting of December 3, 1931)

The three hymenopterous parasites described herewith were discovered by Messrs. Pemberton and Hadden during their explorations for enemies of the insect pests of sugar cane for importation to the Hawaiian Islands. The types are deposited in the collection of the Hawaiian Sugar Planters' Experiment Station, and paratypes in the collection of the author and of the U. S. National Museum.

Family SCELIONIDAE

Scelio serdangensis n. sp.

♀.—Black, the scape, mandibles and legs, including coxae, rufo-testaceous. Tegulae dark castaneous to rufo-testaceous. Wings moderately smoky, much clearer along the anterior margin from the base to a little beyond the end of venation, and with the usual longitudinal hyaline streak just below the middle of disk. Venation testaceous. Head and mesonotum coarsely reticulato-punctate. Lower part of face between each eye and antennal prominence with about four short carinae converging toward mouth. Genal carina twofold, the components hardly spreading apart except close to the eye. Cheeks coarsely reticulato-punctate. Vertex behind ocelli dullish, finely and confluently punctured in the middle and becoming coarsely reticulato-punctate at the sides. Smooth area above antennal prominence reaching about one-third of distance to anterior ocellus, or it may be said to extend a little more than half way, with its upper portion more or less disfigured by transverse carinae. Lateral ocelli about equalling the anterior ocellus in size and almost or quite touching the eye margins. Thorax in lateral aspect nearly twice as long as high, with the propodeum very weakly declivous. Side pieces of pronotum, mesoscutum, and scutellum very coarsely reticulato-punctate, the separating carinae on the mesonotum tending to form prominent longitudinal lines. Apical margin of scutellum smooth and shining. Metanotum very short, having in the middle a vertically declivous surface with a slightly protruding lip above, its vertical surface finely and closely longitudinally striate. Lateral portions of metanotum smooth and polished, each with about seven or eight very deep, round punctures equally spaced in a row. Abdomen moderately broadly fusiform, with the third segment rather less than twice as broad as long. First tergite nearly twice as broad at apex as it is long in the median line. Second tergite deeply impressed across the base. Tergites 1 to 5 longitudinally striate, the striae

leaving a smooth transverse strip on apical margin of tergite 2 and a similar area on the middle of apical margin of tergite 3. Tergite 3 longest, 4 only slightly shorter, and 2 and 5 about three-fourths as long as 3. Antennal scape nearly reaching level of anterior ocellus. Pedicel nearly twice as long as thick. Flagellum moderately stoutly fusiform. Joint 1 of flagellum somewhat longer than the pedicel. Joints 2 to 9 more or less transverse. Joints 2 to 4 distinctly longer beneath than on dorsal side, and 5 slightly longer beneath than above. Joints 2 and 3 subequal, together about equalling 1. Joint 4 on the under side somewhat shorter than 5, and much shorter than 5 on the dorsal side. Joint 5 distinctly longer than the following joint, but not equalling 6+7, nor as long as 1. Joints 6 to 9 subequal in length, 10 slightly longer and pointed at apex but hardly longer than thick. Pubescence of body consisting of coarse, stiff, somewhat flattened setae, silvery white and conspicuous on the head and anterior part of thorax, and somewhat finer, more appressed and less conspicuous on sides of abdomen. Sides of propodeum with very dense, fine, appressed, white pubescence.

Length, 3.4 to 3.8 mm.

♂.—Similar to the female. Antennae piceous, the scape somewhat rufo-testaceous toward base. Legs as in female. Wings clouded only on the apical third. Sculpture similar except that the vertex behind ocelli to the occipital carina is coarsely reticulato-punctate like the frons. Scape shorter than in female, reaching about two-thirds of the distance to anterior ocellus. Pedicel, disregarding the short stalk at base, hardly longer than thick. Joint 1 of flagellum nearly twice as long as thick and about one-third longer than pedicel. Joint 2 about as long as thick and somewhat thicker than 1. Joint 3 much the largest and broadest joint of flagellum and about as long as thick. Joints 4 to 7 each about as long as thick, very similar in shape, but decreasing slightly in size successively toward apex. Joint 8 nearly twice as long as thick and pointed at apex. Pubescence of body fine and considerably less conspicuous than in female.

Length, 3.1 to 3.6 mm.

Described from 14 females, 7 males (holotype ♀, allotype and paratypes) reared from eggs of *Oxya chinensis* (Thunb.) at Serdang, Selangor, Federated Malay States, in October and December, 1930 (C. E. Pemberton).

In Kieffer's key to the species of the Indo-Malayan region (Das Tierreich, 48, p. 309), this species agrees best with *S. consobrinus* Kieffer, from which the female differs in having the lateral ocelli slightly larger and closer to the eye margin, the occiput dullish and much more finely sculptured, and the reticulations of mesonotum forming more definite longitudinal carinae. The male differs from the same sex of *consobrinus* in having more definite converging striae on the lower part of the face, the reticulations of vertex considerably coarser, not becoming finer just above the occipital carina as in *consobrinus*, and the wings clearer

at base and with a rather abruptly bounded pale fuscous cloud on the apical third of disk. In *consobrinus* the cloud has a more yellowish or brownish tint and occupies the apical half but is very indefinitely bounded.

In Dodd's key to the Australian species (Proc. Roy. Soc. Queensland, 38, p. 131-134), *serdangensis* runs to *S. bipartitus* Kieffer from which the female differs in having the first tergite distinctly transverse, the vertex with a finely rugose area behind ocelli, the lateral ocelli closer to the eye margins, the sculpture of mesonotum much coarser and much more distinctly reticulate, etc.

Scelio pembertoni n. sp.

♀.—Black, the basal half of scape, mandibles and tegulae rufo-testaceous. Legs yellowish testaceous, with hind tibiae more brownish and the tarsi somewhat fuscous. Wings moderately smoky, with the usual longitudinal hyaline streak on the middle of disk. Venation fuscous, with the submarginal vein dark brown. Head rather coarsely and closely foveately punctate, but not at all reticulately sculptured. Lower part of face between each eye and antennal prominence with about four short carinae converging toward mouth. Genal carina simple, but joining with a transverse carina on anterior part of cheeks. Ocellar region of vertex with an impunctate transverse space. Area between ocelli and occipital carina deeply punctured like the frons and cheeks. Smooth area above antennal prominence reaching about half way to the anterior ocellus. Lateral ocelli oval, larger than the anterior ocellus and well separated from the eye margins. Scape reaching nearly to the anterior ocellus. Pedicel about thrice as long as thick. Flagellum slenderly fusiform. Joint 1 of flagellum somewhat longer than pedicel. Joints 2 and 3 hardly shorter above than beneath, 2 being slightly longer than thick, and 3 slightly broader than long. Joint 4 distinctly shorter above than beneath and distinctly broader than long. Joint 5 much longer than the preceding or following joint, subquadrate and somewhat broader than long. Joints 6 to 9 subequal in length but decreasing successively in width toward apex, 6 being distinctly transverse and 9 only slightly wider than long. Joint 10 somewhat longer than thick and conically pointed. Thorax in lateral aspect rather less than twice as long as high, with the propodeum very weakly declivous. Dorsal surface of pronotum, the mesoscutum and scutellum foveately punctate like the head. Scutellum with a small projecting tooth on each side. Metanotum distinctly longer than in *serdangensis*. The median part somewhat protruding and rather finely and densely rugose. The lateral parts with a row of about eight punctures along the posterior margin and finely wrinkled in front of the punctures. Propodeum rather coarsely rugose, with about six short longitudinal carinae at the base. Abdomen somewhat narrowly fusiform. Tergite 1 transverse, about twice as broad at apex as the median length. Tergite 2 somewhat broader than long and shorter than 3. The latter about one and one-third times broader than long. Tergite 4 about equal to 2, except that it is a little broader. Tergite 5 about two-thirds as long as 4 and about one and one-fourth times broader at base than long. Tergite 2 slightly depressed at base. Tergites

1 to 5 longitudinally striate, 2 being also rather distinctly reticulate on basal half. The striae on 1 to 3 somewhat irregular, branching or anastomosing, but not so markedly so as in *S. philippinensis* Ashmead. Tergite 2 with a smooth narrow band on apical margin. Tergites 2 and 3 with a similar but less evident smooth strip that is more or less triangularly inclined at middle. Pubescence fine, pale colored but inconspicuous, a single hair arising from each one of the large punctures on head and thorax. The hair on the dorsal surface of thorax is much more abundant than in *serdangensis* but is not easily seen except in profile view.

Length, 3.5 to 4.0 mm.

♂.—Similar to the female. Coloration the same, with the apical fifth of scape and the flagellum very dark brown or fuscous, becoming slightly more reddish beneath. Wings as deeply colored throughout as in the female. Sculpture practically the same throughout as in female. Scape much shorter, reaching about halfway to the anterior ocellus. Pedicel about twice as long as thick and thickest a little before the apex. Joint 1 of flagellum about three times as long as thick and distinctly longer than the pedicel or the following joints. Joints 2 to 7 about equal in length, with joint 3 distinctly thicker than the preceding or following joints, but not conspicuously enlarged as in *serdangensis*. Joints 4 to 7 decreasing only slightly in thickness distad. Joint 8 about twice as long as thick and conically tapering on the apical half. Pubescence as in the female.

Length, 3.1 to 4.25 mm.

Described from 14 females, 7 males (holotype ♀, allotype and paratypes) reared from eggs of *Oxya chinensis* (Thunb.) at Serdang, Selangor, Federated Malay States, in December, 1930 (C. E. Pemberton).

In Dodd's key to the Australian species, this runs to *S. punctaticeps* Dodd, which differs from *pembertoni* in having the basal third of wings pale, tergites 1 to 5 striate, without reticulations on 2, punctures of frons much smaller and not confluent, scutellum without a projecting tooth on each side, second tergite deeply impressed at base, etc.

In Kieffer's key to the Indo-Malayan species, *pembertoni* runs to *S. xanthopterus* Kieffer, but actually agrees better with *S. philippinensis* Ashmead. In all three species the parapsidal lines of the mesoscutum are about equally obscure and better observed at low magnification. The three species may be separated as follows:

1. Wings clouded with more or less dilute fuscous; scape testaceous yellow or rufo-testaceous, with the apex more or less fuscous; scutellum with a little projecting tooth on each side 2

   Wings distinctly yellowish; scape and basal half of flagellum testaceous yellow; scutellum without a projecting tooth on each side, length, about 4.8 mm .... *xanthopterus* Kieff.

2. Tergites 1 to 3 punctate-striate, with the striae on 1 and 2 irregular and more or less anastomosing; length about 3.5 mm.........*philippinensis* Ashm.

   Tergite 2 somewhat punctate on basal half, the striae only slightly anastomosing; tergites 1 and 3 merely striate, with the striae rather regular; scape considerably darker at apex and wings more strongly clouded than in preceding species; length 3.5 to 4.0 mm...... ....*pembertoni* Timb.

The two new species described above are closely allied with two species from Coimbatore, India, named in manuscript by Girault. At least one of these (*oxyae*) has been mentioned in the Indian literature with a few descriptive words, but in no way recognizably described. Mr. Girault named these during his residence at Washington, D. C., but evidently did not complete his study of them before returning to Australia, as he has not published any description as far as known. With apologies to Mr. Girault, therefore, some of the distinguishing characters of his new species are presented in the following table, leaving the question of authorship to some future reviser. The types were deposited by Mr. Girault in the U. S. National Museum.

Table of four Indo-Malayan species of Scelio

1. Lateral ocelli practically touching eye-margin; sculpture of mesonotum coarsely reticulato-punctate; second tergite transversely impressed at base; pubescence coarse, silvery white and conspicuous. 2

   Lateral ocelli well separated from eye margin; mesonotum with shallowly impressed punctures, not at all reticulate; second tergite less distinctly or less abruptly transversely impressed at base; pubescence fine and inconspicuous 3

2. Sides of face between eye and antennal prominence with about four coarse rather long carinae converging toward mouth; genal carina compound, i.e., composed of three carinae lying very close together, but spreading slightly on approach to eye, the outer one branching twice on to the cheek; frons very coarsely reticulato-punctate like the mesonotum; middle of vertex above occipital carina shining, with small punctures set in coarse reticulations similar to those of frons; black, the mandibles, scape, pedicel and legs, except coxae, rufo-testaceous; length about 4.5 mm. (Coimbatore, India, from eggs of Hieroglyphus)..... ....*hieroglyphi* (Girault) n. sp.

   Sides of face with similar but much shorter and less conspicuous carinae; genal carina twofold, the components hardly spreading apart on approach to eyes; reticulations of cheek abutting against the genal carina, vertex between ocelli and occipital carina dullish, finely sculptured and punctured, with hardly a trace of coarse reticulations; frons rather less deeply and less coarsely reticulate than the mesonotum; coloration as in *hieroglyphi*, but coxae pale and pedicel piceous or blackish; length, about 3.1 to 3.8 mm..*serdangensis* Timb.

3. Scutellum unarmed; first tergite of abdomen distinctly longer than wide at base and about as long as the apical width, its surface striato-punctate; second tergite rather strongly impressed on basal half, longitudinally striate except for a smooth area in the middle half of apical margin, the striae more or less irregular and anastomosing toward base of segment; head moderately coarsely and subreticulately punctured; flagellum rather slenderly fusiform; black, the legs, mandibles, scape and pedicel rufo-testaceous, with the femora slightly infuscated at apex, veins of wings testaceous, the marginal vein somewhat infuscated; length, about 3.9 mm. (Coimbatore, India, from eggs of Oxya)........*oxyae* (Girault) n. sp.

   Scutellum with a small projecting tooth on each side; first tergite of abdomen transverse, distinctly shorter than the basal width, its surface coarsely striate and not at all punctate; second tergite hardly impressed at base, rather closely striate except in a narrow strip on apical margin, and the basal half somewhat striato-punctate; sculpture of head and mesonotum coarser than in *oxyae*, with the interspaces between the foveate punctures distinctly less carina-like on the head than in *oxyae*; mandibles, legs and basal half of scape testaceous or rufo-testaceous, with the apex of scape strongly infuscated and the pedicel piceous or blackish; veins of wings rather dark brown, the submarginal a little paler; length, 3.1 to 4.25 mm........................ .*pembertoni* Timb.

Family ENCYRTIDAE

The new species of Anagyrus described below belongs in a group of species having the flagellum white except the first funicle joint which is black or partly black. To this category belong *A. pseudococci* (Girault), *A. subalbicornis* (Girault), *A. dactylopii* (Howard), *A. yuccae* (Coquillett), *A. subalbipes* Ishii, *A. sawadai* Ishii, *A. greeni* Howard, and *A. aurantifrons* Compere. *A. bohemani* as identified by certain authors would also belong here, but Westwood in the original description cites only the "*articulis ultimis albis.*" The new species differs from all of these especially in its unusually depressed form. It may be distinguished from three of the most similar Old World species as follows:

Females

1. Ovipositor not obviously protruded.. 2

   Ovipositor shortly but distinctly protruded, the sheaths broad; hypopygium prominent and extending shortly beyond apex of the last tergite; frontovertex broader than long; clypeal margin with a deep rounded emargination; abdomen slightly longer than thorax (Ceylon)......................
   .... *greeni* Howard

2. Eyes evidently hairy, the pile comparatively dense and long.................... 3

   Eyes almost bare, although an extremely fine, short pile may be distinguished under high magnification; pedicel distinctly longer than the

first funicle joint, which is about twice as long as thick and subequal to each of the next three joints; marginal vein hardly longer than wide, the postmarginal a little shorter than marginal; head and thorax orange yellow with a golden luster. (Hongkong, China, parasitic on *Pseudococcus filamentosus*)..*dactylopii* (Howard)

3. Form ordinary, the abdomen about as long as head and thorax combined; marginal vein about as long as wide; the postmarginal vestigial; pedicel slightly longer than the first funicle joint, the latter slightly longer than the following joint, head and thorax orange yellow, with the mesonotum often more or less dusky, or even almost entirely black. (Sicily, parasitic on *Pseudococcus citri*)..........................*pseudococci* (Girault)

   Form evidently depressed, the abdomen distinctly longer than the head and thorax combined; marginal vein about twice as long as wide, the postmarginal hardly shorter than marginal; pedicel distinctly longer than the first funicle joint, which also is distinctly longer than the following joint; scape only moderately expanded, with the outer face distinctly grooved between the thickened dorsal margin and the ventral expansion; head and thorax bright orange yellow..........*saccharicola*, n. sp.

Males.

1. Head entirely black, the face and cheeks with conspicuous white appressed pubescence 2

   Face more or less brown or orange brown.. 3

2. Pro- and mesopleura entirely orange-brown; eyes almost bare ....*dactylopii* (Howard)

   Mesopleura fuscous or brownish fuscous, with a small spot at the upper anterior corner and the propleura orange yellow; eyes with a short dense pile ....*pseudococci* (Girault)

3. Scape entirely brown; face brown with an orange tint; mesopleura orange brown..*greeni* (Howard)

   Scape fuscous, with the base, excluding radicle, and ventral margin broadly white; face with a ferruginous or orange brown blotch beneath each antenna, but the broad median ridge black; mesopleura fuscous, with a small spot at the upper anterior corner and the propleura pale orange brown ....*saccharicola*, n. sp.

Anagyrus saccharicola n. sp.

♀.—Form strongly depressed. Head thinly submenisciform, distinctly broader than long, with the longitudinal curvature in median line extremely slight from the occipital margin to a point a little above the anterior ends of eyes. At the latter point the curvature becomes much more abrupt toward the oral margin. Eyes moderately large, oval, about twice as long as wide and broader at the anterior end. Inner orbits very slightly divergent anteriorly and almost parallel above. The space between the eyes broad and nearly one and one-half times longer than wide. Ocelli forming a right angle, the posterior pair about their own diameter from the occipital margin and twice as far from the margins of the eyes. Cheeks short and scarcely one-half as long as width of eyes. Antennae inserted close to oral margin, the sockets being much less than half as far from oral margin as their distance apart, and somewhat less than half as far from oral margin as the distance from either to the nearest margin of eye. Antennal

scrobes in the form of rather short grooves, very slightly convergent and not at all united above and ending at a point a little above the anterior ends of eyes. They are separated by a broad convex ridge. Scape of antennae moderately expanded, rather less than one-half as broad as long (excluding radicle) and deeply grooved on the outer side between the thickened dorsal margin and the ventral expansion, with the edge of the thickened part straight and carinate. Pedicel about thrice as long as thick and distinctly longer than the following joint. Flagellum increasing very slightly in thickness toward apex. Funicle joints decreasing slightly in length distad, the first one slightly over twice as long as thick and the sixth about one and one-half times as long as thick. Club ordinary, almost equaling length of three preceding joints combined. Thorax scarcely one-half as thick dorso-ventrally as the greatest width, whereas in ordinary species the depth of the thorax is not much less than the width. Notum strongly flattened. Posterior margin of mesoscutum nearly straight except that it is slightly produced in the middle to cover the inner ends of the axillae. Axillae considerably more than twice as wide as long at outer ends, their inner ends very acute and meeting although concealed by the mesoscutum. Scutellum four-sided, about as wide as long, with the apical angle approximately rectangular, the basal angle very obtuse and the exterior angles rather acute. Apex of scutellum not at all elevated above level of propodeum and fitting into a depression in the middle of the latter. Propodeum therefore apparently composed of two lobes, broad externally and acute mesad where they are separated by the apex of scutellum. Their surface ridged on anterior margin, behind which the surface slopes very gently backward. Abdomen broadly sessile, distinctly longer than the head and thorax combined, very acute at apex and deeply concave above to the base. Ovipositor entirely concealed. Wings moderately wide, reaching to apex of abdomen. Marginal vein about twice as long as wide, the post-marginal subequal to it, and both together about equal to the stigmal vein. Disk of wing nearly uniformly setose throughout. The speculum narrow, almost reaching the stigmal vein and with an oval cut-off portion below. Proximal margin of main portion of speculum bordered with one row of distinctly coarser setae, but these setae are coarse only in comparison with the others. Costal cell with a marginal row of fine setae on the apical half. Submarginal vein with about fifteen to seventeen bristles.

Face dull, very minutely and densely alutaceous, but the scrobal grooves, summit of the ridge between antennae and the inferior inner margin of eyes shining. Mesonotum dullish, not quite so densely alutaceous as the face, the axillae somewhat smoothish, the apical margin of the scutum in the middle and apical margin of scutellum narrowly smooth and shining. Mesopleura smooth in comparison with face but dull. Propodeum smooth and shining. The more or less involuted edges of the tergum of abdomen dull and alutaceous but the concave portion and the venter shining. Pubescence of head and mesonotum extremely fine, short and whitish and although rather dense it is inconspicuous. It is erect on the face and cheeks and depressed on the notum. Occipital margin of vertex with a few longer erect fuscous setae and the superior inner orbits with a row of about six similar setae. Metapleura and sides of abdomen with pubescence similar to that of mesonotum, becoming longer, erect but sparser toward apex of abdomen. Eyes with a dense erect pubescence, about as long as that of the frons.

Head and thorax orange yellow, the tegulae and prepectal plates whitish, the oral margin of face very narrowly, occiput, dorsal surface of propodeum and the abdomen fuscous or blackish. Scape, pedicel and first funicle joint black, the following joints white. Scape with a narrow oblique band across the apical part, the dorsal margin from base to a little beyond the middle and on exterior face from there to apex, and the groove on exterior side broadly from base to apex, white. About the apical third of pedicel white. Legs, including coxae, creamy white, with the tarsi, especially middle pair, more yellowish, and the dorsal margin of the middle and hind femora and tibiae somewhat dusky. Wings hyaline, the veins dilute fuscous.

Length, 1.22 to 1.75 mm. Length of head (in specimen 1.72 mm. long), 0.397; width of head, 0.481; thickness of head, 0.213; width of vertex at anterior ocellus, 0.224; length of antenna, 0.969; length of scape (excluding radicle), 0.239; width of scape, 0.094; width of mesoscutum, 0.496; length of fore wing, 1.13; width of fore wing, 0.468 mm.

♂.—Head about ordinary in shape for males of Anagyrus, subrotund as seen from in front and slightly broader than long. Frontovertex about one and one-half times wider than long. Ocelli forming a right angle, with the posterior pair very close to occipital margin and nearly twice their diameter from margin of eyes. Eyes broadly oval, less than twice as long as wide and broader at lower end. Cheeks in frontal view nearly continuous with outline of eyes and about as long as width of eyes. Face with a broad, low, rounded, median ridge extending from clypeal margin to a little above the antennal sockets. The latter situated slightly above the ocular line, with their lower margins approximately tangent to this line, their distance apart subequal to the distance from either to the eye margin. Scrobes very short, shallow and uniting above in a broad curve. Scape short, and including radicle only slightly longer than pedicel and first funicle joint combined, narrowly oval, and slightly expanded beneath. Pedicel hardly longer than thick and about one-third as long as following joint. Flagellum elongate filiform, with rather long scattered hairs. First funicle joint nearly four times as long as thick. The following joints subequal and about two-thirds as long as first funicle joint. Club slightly longer than the last two funicle joints combined. Sixth funicle joint armed beneath with a row of six conidium-like setae and base of club with one similar seta. Thorax depressed and similar in structure to that of female. Abdomen depressed, considerably shorter than thorax and narrowly truncate at apex. Cercal plates retracted to the basal third of the length, the setae very long. Wings much shorter and broader than in the female. Speculum also much broader and reaching from stigmal vein to opposite margin of disk, except for a slight interruption which cuts off a rounded area touching the posterior margin of wing. Basal area of disk with the setae sparser and somewhat coarser than those beyond the speculum. Costal cell broader than in the female, with one marginal and one incomplete submarginal row of setae. Venation practically as in the female.

Sculpture extremely fine and alutaceous, producing an opaque effect, but the axillae, extreme apical margin of scutellum, pleura, propodeum and abdomen somewhat shining. Face with sparse, very short, appressed whitish setae. Frontovertex and mesoscutum with similar more erect, dusky setae, which are hardly visible except in profile view. Scutellum with very

sparse, rather long setae and an apical pair of longer bristles. Eyes with sparser and slightly shorter pile than in the female.

Dull black, the face on each side of the median ridge ferruginous or orange brown. Scape blackish, with the base, excluding radicle, and ventral margin broadly white. Flagellum dilute fuscous. Legs, including coxae, yellowish white, with apex of last joint of tarsi dusky. Wings hyaline, the veins dilute fuscous.

Length, 0.71 to 1.09 mm. Length of head (in specimen 0.97 mm. long), 0.317; width of head, 0.376; width of frontovertex, 0.209; width of mesoscutum, 0.396; length of fore wing, 0.865; width of fore wing, 0.399 mm.

Described from 6 females, 5 males (holotype ♀, allotype and paratypes) reared from *Trionymus sacchari* (Cockerell), collected at Serdang, Selangor, Federated Malay States, Nov. 11, 1930 (C. E. Pemberton), and 13 females, 14 males (paratypes) reared from the same host, collected at Los Banos, Luzon, Philippine Islands, August 27, 1930 (F. C. Hadden). Also a series of 6 females, 2 males (paratypes) reared from an unidentified mealybug, collected at the Tsetse-fly Laboratory, Zululand, Natal, December 10, 1925 (E. W. Rust).

ANNUAL ADDRESS

The Economic Importance of the Mediterranean Fruit Fly to Hawaiian Horticulture

BY ARTHUR C. MASON
Bureau of Entomology, U. S. Department of Agriculture
(Presented at the meeting of December 3, 1931)

The Mediterranean fruit fly (*Ceratitis capitata* Wied.) has been the subject of much discussion in recent literature, both as to its possible distribution in nature and as to its potential economic effect on horticulture. The insect has proved to be a destructive pest in every country where it has become established. In the Hawaiian Islands an almost ideal environment for the fly exists, since the temperature and humidity ranges during a great part of the year are within the optimum limits for its development and, in addition, a continuous succession of host fruits is available. These facts, coupled with the enormous fecundity of the insect, have caused its rapid increase and dissemination over the Islands, resulting in considerable damage to horticultural crops. However, after a period of more than 20 years under conditions brought about by the Mediterranean fruit fly, a substantial basis for horticulture still remains, and many fruits and vegetables are produced for local consumption.

Generally considered to be dependent on outside sources of supply for fresh produce, the Islands are largely self-supporting in this respect. Although considerable quantities of fruits and vegetables are imported for local use, this produce is of the varieties which do not grow well here because of climatic conditions or because they can be grown to better advantage elsewhere.* Hawaii not only produces large quantities of fruits and vegetables for home consumption, but could doubtless raise additional supplies for export if there were no quarantine restrictions. During the year of the fruit-fly outbreak in Florida, the Bureau of Entomology laboratory in Hawaii had an unusually large number of

* In the case of tomatoes and possibly some other fruits, insects other than the fruit fly limit their production locally.

visitors seeking information about the fly. Among these were people vitally interested in fruit growing in the States. Almost without exception these people expressed surprise at the quantity and variety of fruits grown here.

The present condition of horticulture in Hawaii, however, is no justification for the existence of the fruit fly, either here or elsewhere. It is generally agreed that absolute freedom from the pest would produce a much happier state of affairs. Neither is it an argument against the existing quarantines. The writer firmly believes that there should be no relaxation in present quarantines, and that every effort should be made to limit the distribution or spread of the fly. The pest has possibilities for great damage to horticulture in some sections of the United States. The methods by which Florida achieved apparent success in eliminating the insect from the State are hardly applicable to Hawaii at present. Nevertheless, all effort should be expended not only for better control, but looking toward the ultimate elimination of the insect from Hawaii.

HISTORY OF THE PEST IN HAWAII

An extended study of the Mediterranean fruit fly in Hawaii has been conducted by the Bureau of Entomology almost from the time the insect became established here. First found in Honolulu, in 1910, its dissemination was rather rapid, until by 1914 it had spread to all the islands of the group. Nearly ten years were required, however, for it to reach its maximum distribution and population, as is shown by yearly records of infestation started by the bureau in 1912 and continued up to the present. Willard and Bissell (8) show that the average number of larvae per fruit during the period 1916-1924 reached its maximum point in 1917 and 1918. It is interesting to note that the introduced parasites also reached their maximum, both in numbers and in efficiency of control, at about the same time.

In 1913 and 1914 the Territory successfully introduced four parasites: *Opius humilis* Silv., *Diachasma tryoni* Cam., *Diachasma fullawayi* Silv., and *Tetrastichus giffardianus* Silv., which have been of material assistance in reducing the population of the flies. These parasites have spread throughout the range of the fruit fly

and have adapted themselves to their new environment. Parasitism of the fruit-fly larvae increased yearly until 1918, when, as shown by Willard (6), a total parasitism of about 50 per cent was attained for all larvae examined. Yearly records made since then indicate little, if any increase in efficiency of the parasites. Results as shown by Willard and Bissell (8) for the years between 1916 and 1924, as well as later manuscript reports by Willard and Mason, show that the average yearly percentage of parasitism remains around 50 per cent. A fairly constant relationship between the parasites and the fruit fly has been maintained. Although an average of approximately half of the larvae are destroyed by the parasites, the amount of infestation has remained more or less stable.

EXPERIMENTAL PROCEDURE

The study of the economic effect of the Mediterranean fruit fly on horticultural crops described herein was therefore made under conditions of parasitism as outlined, and which are considered as fairly stable and continuing. Records of infestation in many of the host fruits of the fly are presented, and the relation of its injury to Hawaiian horticulture is shown. These fruits will be discussed in the order of their economic value to the islands. Unless otherwise stated, all the records were made from tree-ripened fruits. The samples of fruits were picked from the trees when they had reached a mature or edible condition. They were then taken to the insectary and placed on an inch or two of dry, clean sand in individual containers. Here they were kept, usually for 20 days. At the end of each five-day period the sand was sifted, the larvae and pupae were removed and counted, and a record was made of the number obtained. After four such siftings the total infestation for each fruit was determined. Whenever it was possible, samples were taken from several different localities in order to have representative collections.

PINEAPPLES

The pineapple (*Ananas sativus*) naturally comes first in this discussion, since pineapple growing ranks second only to sugar among Hawaiian industries. It is well known that pineapples are free from any damage by *Ceratitis capitata*. No instances are on

record in Hawaii of a pineapple being infested by this insect. Repeated attempts, as reported by Back and Pemberton (3), to rear the fruit-fly larvae under forced conditions in ripe pineapples have always failed, although these authors refer to attack on pineapples in the Fiji Islands by the pineapple fruit fly (*Dacus xanthodes* Broun) and the Queensland fruit fly (*Dacus tryoni* Frogg.), neither of which occurs in Hawaii. There are no restrictions on the exportation of this fruit.

COFFEE

Second in order of horticultural value and fifth among Hawaiian industries is the coffee crop. From the beginning of fruit-fly infestation in the Islands, coffee (*Coffea arabica*) has served as an important host of the fly. Infestation in the coffee fields rapidly increased from the start in 1912, and soon reached the point where about 90 per cent of the cherries were infested. Although it was recognized from the beginning that the larvae were in no way injuring the coffee seeds, their presence in the surrounding pulp reduced the weight of the cherries and thus disturbed the system of picking and marketing then in use, and also caused dropping of the cherries, due to fungous diseases and fermentation.

The introduction of the opiine parasites solved these difficulties at once. These parasites were liberated in the Kona coffee fields in 1914-15, and found conditions ideal for their development. The coffee cherry being a small fruit with thin flesh, the parasites could readily reach the fly larvae and oviposit in them, and there was a rapid increase in parasitism and consequent decline in fly population. This rapid reduction of fruit-fly population in the coffee fields has often been cited as an outstanding instance of parasite control. Willard (7) states that the average number of larvae per thousand coffee cherries obtained in 1917 was 765, 42 in 1923, 33 in 1924, and 19 in 1926. Some recent records of infestation in individual coffee cherries show an average of 2.1 larvae per infested fruit. On this basis the actual number of coffee cherries infested in the Kona coffee fields is less than 10 per thousand. Damage by the fruit fly has not for several years been considered a factor in coffee growing.

BANANAS

Bananas of the Chinese (*Musa cavendishii*) and Bluefield (*Musa sapientum*) types are the only other Hawaiian fruits grown for export, as well as for home use. These fruits are permitted to enter the States upon certification as to their condition of nonmaturity at the time of packing for shipment. The fruit fly has never been found infesting bananas of these types growing under natural conditions in Hawaii.

Back and Pemberton (2) report that a careful examination made of more than 30,000 fruits ready for shipment did not show a single egg puncture; also that 1,014 prematurely ripened fruits cut from bunches in the field and held in rearing jars in the insectary did not produce a single larva. Fly-traps maintained in the fields while the fruits were growing showed an abundant fly population.

Although infestation in ripe bananas on the tree can be produced under forced conditions, such is not true of green bananas on the tree, owing largely to the exudation of the tannin-laden sap which prevents the female from ovipositing. Hence, as a precautionary measure, green fruits only are permitted for export, all prematurely ripened and cracked fruits being removed from the bunches before they are wrapped. The common horticultural practice is to pick bananas while they are still hard and green so that even if the fly did attack the ripe fruits in the field, this would not be a factor in their production either for home use or for export. In his bulletin on banana culture in Hawaii (4) Pope states that "no evidence has been obtained indicating that commercial varieties are susceptible to attack by the pest. This fact has failed to receive the publicity to which the banana industry is justly entitled." This applies to the types named at the opening of this paragraph.

In the case of cooking bananas, there are a few instances on record of infestation to fruits growing under natural conditions. Back and Pemberton (2) report a single instance each of infestation in Popoulu and Moa varieties (*Musa* spp.). Willard, in an unpublished manuscript on the susceptibility of cooking bananas to attack by the fruit fly, reports that he examined 8,296

fruits of Maiamaoli bananas from Honolulu markets and found 13 of them to have egg punctures, a few of which contained dead eggs or dead young larvae. Similarly, an examination of 200 fruits of the Popoulu cooking bananas showed egg punctures in 5 fruits, from one of which 10 adult flies were reared. Cage experiments demonstrated that it was possible for adult flies to oviposit in green cooking bananas on the trees, but no adults could be reared. Only in ripe or cut green bananas was it possible to rear the flies to maturity. The few known cases of infestation in cooking bananas make it unwise to allow them to enter the States, but does not limit the production and consumption of these bananas locally.

AVOCADOS

Avocado growing has great possibilities in Hawaii, especially since the Guatemalan types have been introduced and found to meet with favor. Local markets are well supplied with these fruits throughout the greater part of the year, and only the quarantine laws prevent the development of a large industry for export purposes. It has been demonstrated that all types of the avocado (*Persea gratissima*) are possible carriers of the fruit fly, although the infestation is so slight that it is not considered in raising fruits for local use.

Figures published by Willard and Mason (9) from extensive work with Guatemalan avocados between 1925 and 1929 show that, of 1,269 fruits, representing 12 varieties grown under natural orchard conditions, only 5 fruits were infested. This represents less than four-tenths of 1 per cent of the entire lot. When adult flies were caged about the fruits on the trees for 24 hours, 1.3 per cent of 231 fruits became infested. Even when held under forced conditions in jars in the insectary, 826 fruits had infestation in only 18, or 2.2 per cent of the total number. These figures indicate that the fruit fly is a negligible factor in the production of Guatemalan avocados for local use.

The so-called summer avocados of the West Indian race are sometimes attacked more severely by the fruit fly. Even here infestation is, in the main, limited to a few trees where the fruits perhaps lack the qualities of resistance shown by most varieties.

Two hundred summer pears collected in the vicinity of Honolulu and held in the insectary for individual infestation records gave an average infestation of 4 per cent. All the infested fruits of this group came from the same tree in Manoa; five collections from other trees had no infestation. Seventy-one fruits of the Wishard variety, recently received from Haiku, Maui, had an average infestation of 25.3 per cent, while samples of several other varieties from the same orchard collected about the same time had no infestation. A tree growing in the writer's dooryard has produced several hundred high-quality fruits during the past two years and only two infested fruits have been noted.

Certainly the fruit fly receives little consideration in raising avocados for home and market use in Hawaii. Elimination of the occasionally infested tree or the varieties most susceptible to attack would almost entirely remove the fruit-fly problem from avocado growing. Even the common practice of picking avocados while they are hard, in order to facilitate handling and insure their reaching the consumer in good condition, eliminates most of the chance of infestation.

PAPAYAS

The papaya (*Carica papaya*) is an important commercial crop in Hawaii and a regular article of diet in most homes. Fruit-fly infestation in these fruits is so rare that they are not even considered by most people to be a host. The writer has never seen a papaya on the market which showed the presence of maggots. The usual commercial practice of picking papayas while they are still firm and just starting to show the ripening color removes practically all chances of infestation, since the female fly seldom, if ever, oviposits in a green papaya, as the exudation of the milky acrid juice which occurs as soon as the fruit is punctured prevents the fly from inserting her ova. In addition, experiments have shown that the young larvae are unable to live in the green fruits. If the fruits are allowed to remain on the trees until they are very soft and ripe, infestation often takes place. Of 171 such fruits, picked from the trees after becoming very soft and in most cases overripe, 23.4 per cent showed infestation. Inasmuch as papayas picked while they are still firm are considered preferable to tree-ripened fruits for culinary pur-

poses, the fruit fly can not be considered a factor in limiting their production. The fruits are, at present, so abundant that they are often used for chicken feed and hog feed.

MANGOES

The mango (*Mangifera indica*) is one of the most favored hosts of the fruit fly and perhaps its main supporting host during the summer season. Still, several of the finest varieties of mangoes in Hawaii are almost free from attack, even when growing in an environment of concentrated fly population. The common seedling mangoes, however, are so badly attacked that the crops are considered of little or no value. Infestation in certain samples of these fruits has reached 100 per cent. A comparative study made during the past two years of the infestation in several varieties of mangoes shows the average infestation to range from zero up to 58.8 per cent. In Table 1 the varieties of mangoes studied are listed in the order of their freedom from attack; and the number of fruits examined, the number infested, and the percentage of infestation are shown.

TABLE 1.—FRUIT-FLY INFESTATION IN MANGOES

Variety	Number examined	Number infested	Per cent infestation
Bierbach	18	0	0
Victoria	182	2	1.1
Pirie	121	2	1.6
Smith-Wootten	150	3	2.0
Cowasjee-Patel	37	1	2.7
Whitney	113	4	3.5
No. 9	112	5	4.4
Mullgoa	38	2	5.3
Ehrhorn	214	12	5.6
No. 5	43	3	7.0
Scott-Pirie	53	4	7.5
Wootten	144	11	7.6
Holt	63	5	8.0
Manila	100	14	14.0
Chinese	25	6	24.0
Hawaiian	643	227	35.3
French	85	50	58.8

It is seen that less than 5 per cent infestation was found in several of the best varieties of mangoes growing here. In the case of the Hawaiian mangoes infestation averaged 35.3 per cent in 643 fruits collected from several localities about Honolulu; in French mangoes it reached an average of 58.8 per cent. When it is known that most of the better varieties of mangoes examined came from trees in the experimental orchards of the Hawaii Experiment Station, in close proximity to other heavily infested host fruits, and also that flytraps maintained in the trees themselves showed large numbers of flies present during the ripening season, it will be realized that these fruits have considerable resistance to attack. The results prove, therefore, that it is possible to grow good mangoes in Hawaii in spite of the fruit fly. Pope (5) lists eight varieties as being immune or nearly free from attack. Recently some new seedling varieties have been developed with fruits of exceptional quality, color, and size, and which as yet have shown no evidence of fruit-fly injury. These facts all tend to substantiate a belief, long held by the writer, that elimination of the undesirable Hawaiian mangoes either by top-working over the trees or replacing them entirely with trees of the better varieties not only would result in the production of a superior crop of mangoes remarkably free from infestation, but also would materially reduce the fruit-fly population of the Islands by removing its main supporting summer host in the lowlands of Hawaii.

GUAVAS

The guava (*Psidium guayava*) is another of the chief supporting hosts of the fruit fly in Hawaii. Growing over a large area of the wild and mountainous portions of the Islands and extending up to the limits of range of the fly, the trees provide an almost constant supply of host fruits. The fruits are universally infested, although at the lower elevations (up to 500 feet) the average infestation and the average number of larvae per fruit are greater than at the higher elevations. In 1,485 fruits representing collections from many localities and from sea level up to 2,000 feet, the average infestation was 61.6 per cent, with an average of 10.9 larvae per infested fruit.

In making these infestation records it was found that only 3.4 per cent of the larvae emerged from the fruits during the first five days of holding, and that 45.2 per cent emerged after the tenth day. As in the case of most other fruits studied, the guavas were picked from the trees when ripe and yellow and in an edible condition, at which time, the records indicate, the insects are in the egg or first larval stage. Since fruits for processing are desired at this same stage of maturity, and are used before any decay resulting from infestation has set in, the presence of the insects does not interfere with their use or depreciate their value. Normally the fruits have fallen from the trees and are well decomposd before the larvae leave them.

Although not cultivated as a horticultural crop, the guava fruits have some commercial value in the making of jam, jellies, ice cream, etc. For these purposes, as previously explained, the infestation by the fly can not be said to lessen the value of the fruits.

Infestation of the guava fruits by the fly has apparently had no effect on the rapid spread and dissemination of the host trees over the Islands.

CITRUS FRUITS

The effect of the presence of the fruit fly in Hawaii on citrus growing is difficult to estimate, owing to the scarcity of citrus fruits for study, and especially to the absence of large plantings. Orange trees were grown more generally in the early days, and at one time oranges were exported to California, but this practice was discontinued long before the advent of the fruit fly in Hawaii. Practically all the citrus fruits consumed locally are now imported from California; so, while the fruit fly undoubtedly exerts a limiting influence on dooryard production of oranges, it is not believed that its presence affects the commercial production to a very great extent.

Some records were made in 1929-30 on oranges (*Citrus sinensis*) obtained from a planting in Kona, Hawaii. This grove, composed of about 350 sweet seedling trees, is probably the largest single planting in the Islands. From 638 fruits picked from these trees at several times during the season and held over sand in the insectary, a total of 122 larvae were obtained. Unfortunately, in-

dividual records on the fruits were not made. However, assuming 6 larvae per infested fruit, which is a conservative estimate, there were about 20 infested fruit—an infestation of about 3.2 per cent of the entire lot.

Practically all of these larvae were obtained from fruits picked in late December and January. The owner of the grove attempts to market all the fruits before Christmas, and stated that he had little trouble from fly infestation unless the fruits remained on the trees after the first of January. Back and Pemberton (1) reached a similar conclusion from their study of the susceptibility of citrus fruits to attack by the Mediterranean fruit fly. They state: "While grapefruit, oranges, lemons, and many limes may become quite badly infested with well-grown larvae if allowed to remain on the tree long after they become sufficiently ripe for the market, nature has so well equipped them to withstand attack that larvae are seldom found in their pulp until they are much overripe."

The thin-skinned oranges of the satsuma and tangerine types (*Citrus nobilis*) are much more seriously attacked. Samples taken from the small satsuma grove in Kalihi Valley, and consisting of 75 fruits which were unprotected and had ripened on the trees, had an infestation of 33 per cent. The owner of this grove finds it necessary to protect all the fruits on the trees with paper sacks in order to insure freedom from attack by the flies so that he can produce a marketable crop. In the case of the tangerines a single sample of 25 fruits had an infestation of 16 per cent. Similarly, 75 scented oranges from the experiment station orchard averaged 25.3 per cent infestation.

Lemons (*Citrus limonia*) are practically immune to damage by the fruit fly. Fifty-five Villa Franca lemons and 75 seedling lemons failed to show any infestation. Back and Pemberton (3) also state that they have never seen an infested lemon that had not been mechanically injured. Limes suffer slightly when allowed to remain on the trees until very ripe; 375 such fruits of the Kusaie lime (*Citrus aurantifolia*) were infested to the extent of 8.8 per cent. In the case of the grapefruit (*Citrus grandis*) infestation is also found in overripe fruits; 150 Whitney pomelos averaged 8.7 per cent infestation. However, all the infested

fruits were found late in the season and those picked shortly after they had reached maturity were free from attack. The sour orange (*Citrus aurantium amara*) is probably the most favored host among the citrus fruits, 76 per cent of 100 fruits having been found infested with an average of 31.5 larvae per fruit. The calamondin or Chinese orange (*Citrus japonica*), a tree grown mostly for ornamental purposes, is also a favored host, 409 of the fruits collected from several of these trees showing an average infestation of 59.2 per cent.

Most of the citrus fruits from which records were made were obtained from the Hawaii Experiment Station orchard, where they were exposed to heavy attack due to continuity of hosts and to the fact that many of the fruits remain on the trees until overripe and often until they drop.

FRUITS OF LESSER COMMERCIAL VALUE

Grapes of the Isabella variety (*Vitis labrusca*) are grown to a limited extent for local markets and home use. In 150 bunches of these grapes, representing six collections, no larvae were found when the grapes were held over sand in the insectary. Neither have any instances of field infestation in Island grapes ever been noted by the writer. Back and Pemberton (3) mention a single case of infestation found in locally grown grapes. In an effort to obtain infested grapes for experimental use, oviposition was accomplished only under forced conditions in the insectary. Later examination of these grapes showed only 133 larvae and 652 dead eggs, indicating that more than 83 per cent of the eggs failed to hatch in the grapes.

The fig (*Ficus carica*) is a favored host of the fruit fly and the fruits are often heavily infested if left on the tree until they are very soft and ripe. The milky acrid juice of the green figs, however, generally prevents oviposition by the flies. One hundred tree-ripened figs held over sand yielded a total of 342 larvae from 36 of the fruits. Only 22 per cent of the larvae emerged during the first five days of holding, however, indicating that the larvae were very small at the time the fruits were picked. The common practice of picking figs while still firm in order to facilitate market handling usually removes them from the tree before they are subject to infestation. On the other hand, on dooryard trees

bagging of the fruits is sometimes resorted to. Many lots of ripe figs purchased in the market for home use have failed to show any decay due to infestation. Complete immunity to fly attack on one variety is claimed by the grower of these figs.

The breadfruit (*Artocarpus incisa*), although listed by Back and Pemberton (3) as a host, is probably never infested. These authors state that there are no definite records of infestation available. Forty-four recently fallen and overripe fruits held in the insectary failed to produce a single larva, and no instance of infestation has been called to the writer's attention.

In the case of the mangosteen (*Garcinia mangostana*) only 1 of 75 fruits examined, or 1.33 per cent, was found to be infested.

The loquat (*Eriobotrya japonica*) is one of the favored hosts of the fruit fly. In 300 fruits, representing 12 collections, there was an infestation of 80 per cent, with an average of 8.7 larvae per infested fruit. Successful production of loquats under present Island conditions requires bagging of the fruits, but these fruits have little commercial value.

Sapodillas (*Achras sapota*) are also heavily infested when grown unprotected. A small sample of fruits held in the insectary had an infestation of 62.5 per cent. Only an occasional tree of this species grows in the Islands and the fruits are in little demand.

The strawberry guava (*Psidium cattleianum*) is severely attacked by the fruit fly when allowed to mature on the trees. 250 fruits having an average infestation of 72.8 per cent. As in the case of the regular guavas and figs, however, oviposition rarely takes place until the fruits are very soft and ripe. Only a small percentage of the larvae in the samples of tree-ripened fruits under observation emerged during the first five days of holding. Since the chief use of the strawberry guava is for cooking and jelly making, the presence of the insects in the egg and early larval stages can not be said to depreciate their value very much.

Two samples of mountain apples (*Jambosa malaccensis*), taken at the lower altitudes of its range and near cultivated host fruits of the fly, were infested to the extent of 58 per cent. Usually growing wild well up in the mountain forests, the fruits of this tree are ordinarily free from infestation, and good fruits are commonly offered for sale during the season.

FRUITS OF DOUBTFUL COMMERCIAL VALUE

Another group of fruits, although of rather doubtful commercial value, will be considered here since it contains some important hosts of the fruit fly. This group contains the star apple (*Chrysophyllum cainito*), rose apple (*Eugenia jambos*), French cherry (*Eugenia uniflora*), white sapota (*Casimiroa edulis*), carambola (*Averrhoa carambola*), and Natal plum (*Carissa arduina*). These fruits are grown to a limited extent in home gardens either for food value or ornamental purposes.

Infestation records as determined for these fruits are given as follows: 235 star apples, representing 10 collections of fruits, had an average infestation of 50.2 per cent; in 400 rose apples there was an average of 76 per cent attacked, two of the samples of 25 fruits each showing 100 per cent infestation; 19 collections of French cherries, representing a total of 475 fruits, varied in degree of infestation from 8 to 100 per cent, with an average of 53 per cent; 3 small samples of white sapotas, representing 33 fruits, were 100 per cent infested in each case; 5 lots of carambolas, with a total of 122 fruits, contained 3 infested fruits, or an average infestation of 2.4 per cent; Natal plums were 14 per cent infested in 4 collections, representing 100 fruits.

VEGETABLES

This discussion will not be complete without considering some of the vegetable crops which are purported to be hosts of the fruit fly. In this connection the attack of the fruit fly must not be confused with the damage caused by the melon fly (*Bactrocera cucurbitae (Coq.)*), a related insect which is primarily an enemy of certain vegetable crops.

The tomato (*Lycopersicum esculentum*), although commonly considered as a host, has never been found to be attacked. From 648 fruits, representing 25 different collections, no larvae were obtained when the fruits were held in the insectary. Neither are any authentic records available of fruit flies having been reared from tomatoes grown under natural field conditions. Tomatoes have often been infested artificially and the larvae reared through in them, but they are not attacked in the field. Although listing tomatoes as a host of the fruit fly, Back and Pemberton (3) have not recorded any instances of natural infestation.

Eggplants (*Solanum melongena*) are also listed by Back and

Pemberton (3) as hosts, but their records show only one infested fruit from 1,115 examined, or less than one-tenth of 1 per cent. In an effort to obtain infested eggplants for experimental use, 132 fruits were placed in jars containing adult flies and held in the insectary. Even under such forced conditions, infestation was obtained in only 3 of these fruits. Hence it appears that eggplants are most improbable hosts of the fruit fly.

Onions are sometimes considered as possible carriers of the fruit fly. Work conducted a few years ago by H. F. Willard, and reported in manuscript only, shows that the fruit fly could not be reared through in onions of the Australian brown and Spanish types. Although adult flies would deposit eggs in the onions under forced conditions, none of them were able to develop. No instances are on record of infestation in onions in Hawaii. The same is true of beans of all types, although broadbeans have been reported (in correspondence) as a host in Bermuda.

Melons of all kinds are severely infested by the melon fly, but not by the fruit fly. Although fruit flies have often been reared from melons infested in the insectary, no records are obtainable of infestation under field conditions.

The green pepper (*Capsicum annuum*) is the only vegetable in which natural infestation by the fruit fly has been found. Among 197 green peppers purchased in the local markets, 19 infested fruits were found, or an average of 9.6 per cent infestation, and with an average of 5.2 larvae per infested fruit. Another lot of several sacks of green peppers was purchased for cold-storage experiments, and from 150 fruits selected from the lot as checks to determine the larval population, 66 larvae were obtained. Figuring the individual infestation on the average of 5.2 larvae per fruit as given above, about 12 fruits, or an average of 8 per cent of the lot, were infested. This figure is comparable with that of the first lot, and shows that green peppers average about 9 per cent infestation. As in the case of some previously mentioned fruits, only about 25 per cent of the larvae emerged during the first five days of holding. Hence, it will be seen that little decay or loss results from fruit-fly infestation in peppers.

CONCLUSION

Infestation records are included on all the important supporting hosts of the Mediterranean fruit fly, and the injury to such

hosts is indicated. These records show that Hawaii is able to grow an abundant crop of fruits and vegetables for home use, and in some cases for export, with little loss caused by the fly. Although severe infestation does take place in some varieties of citrus fruits and mangoes, in peaches, guavas, figs, and some of the minor fruits, including both edible fruits and fruits of ornamental plants and trees, some of these host fruits are not of commercial value, or can be picked before infestation occurs or used in ways to overcome the factor of infestation. The green pepper is the only vegetable crop whose production is affected by fruitfly infestation. Among the fruit crops the production of pineapples, bananas, avocados, papayas, some kinds of citrus fruits and mangoes, grapes, breadfruit, mangosteens, and some other lesser important fruits is scarcely, if at all, limited by the presence of the fly. Strawberries, mulberries, pohas, and some of the other minor fruits are not classed as hosts.

The growing of more resistant varieties of some of the favored hosts, elimination of nonessential host fruits, and a program of control through orchard and dooryard sanitation, together with the use of poison bait spray, would probably result in largely removing the insect from the lowlands of Hawaii.

LITERATURE CITED

(1) Back, E. A., and Pemberton, C. E. 1915. Susceptibility of citrus fruits to the attack of the Mediterranean fruit fly. Jour. Agr. Research 3: 311-330, illus.

(2) Back, E. A., and Pemberton, C. E. 1916. Banana as a host fruit of the Mediterranean fruit fly. Jour. Agr. Research 5: 793-804, illus.

(3) Back, E. A., and Pemberton, C. E. 1918. The Mediterranean fruit fly in Hawaii. U. S. Dept. Agr. Bul. 536, 119 pp., illus.

(4) Pope, W. T. 1926. Banana culture in Hawaii. Hawaii Agr. Expt. Sta. Bul. 55, 48 pp., illus.

(5) Pope, W. T. 1929. Mango culture in Hawaii. Hawaii Agr. Expt. Sta. Bul. 58, 27 pp., illus.

(6) Willard, H. F. 1920. Work and parasitism of the Mediterranean fruit fly in Hawaii during 1918. Jour. Agr. Research 18: 441-446.

(7) Willard, H. F. 1927. Some observations on the ecology of the Mediterranean fruit fly *Ceratitis capitata* Wiedemann and its parasite. Proc. Hawaiian Ent. Soc. 6:505-515.

(8) Willard, H. F., and Bissell, T. L. 1930. Parasitism of the Mediterranean fruit fly in Hawaii, 1922-1924. U. S. Dept. Agr. Circ. 109, 12 pp.

(9) Willard, H. F., and Mason, A. C. 1929. Susceptibility of avocados of the Guatemalan race to attack by the Mediterranean fruit fly in Hawaii. Hawaii Forester and Agr. 26: 171-176.

Some Observations on Forest Insects at the Nauhi Nursery and Vicinity on Hawaii

BY O. H. SWEZEY AND F. X. WILLIAMS

(Presented at the meeting of November 5, 1931)

Through the courtesy of the department of forestry, the writers had the opportunity of spending a week the latter part of September and beginning of October, 1931, at the forest nursery on Nauhi Gulch, at an elevation of 5,250 feet. This is at the upper edge of the Hilo Forest Reserve, and in the land of Honohina, about 12 miles up from the coast. This region of this great forest belt on windward Hawaii has never been explored entomologically. During the few days there, we studied the insect faunas of the chief trees making up the jungle in the forest reserve, and the remaining trees in the ranch land which occupies a wide belt above the forest. We also went up the side of Mauna Kea above the forest line to an elevation of 8,500 feet, and one day made the ascent to the summit of Mauna Kea, under the guidance of the forest ranger, Joe Ignacio. (The insects captured at the summit are listed on pages 191-192 of this issue.)

The koa (*Acacia koa*) is a prominent tree of the region, and, as evidenced by standing dead trunks and rotten logs, formerly made up a considerable part of the forest that previously covered the land which has been occupied as ranch for a long period of time. There are some remaining living trees on the ranch area, particularly in and along the gulches. The most prevalent tree in the forest reserve is the ohia lehua (*Metrosideros polymorpha*). It also extends somewhat up into the ranch area. The mamani (*Sophora chrysophylla*) makes up a considerable belt of open forest at an elevation of 7,000 to 8,500 feet, with scattering trees at lower elevations. The naio (*Myoporum sandwicense*) has scattered stands in the ranch area. Koolea (*Suttonia lessertiana*) is found sparsely in the forest reserve and also somewhat higher up. The same applies to olapa (*Cheirodendron gaudichaudii*). The mamake (*Pipturus albidus*) is not common and *Broussaisia arguta* is more in evidence in the forest reserve. A species of

Coprosma is quite common in the jungle of the forest reserve and is also found in the gulches at higher elevations.

Of the undergrowth making up the jungle of the forest reserve there are many pulu ferns (*Cibotium chamissoi*). *Dryopteris paleacea* is another very abundant fern. There are thickets of akala (*Rubus hawaiiensis*), and clumps of a tall species of ohelo (*Vaccinium* sp.) are common. Puakeawe (*Cyathodes tameiameia*) is also abundant in places.

Certain trees which are usually components of the endemic forests were not observed in the region, namely: Straussia, Bobea, Pelea, Elaeocarpus, Antidesma, Perrottetia and Maba. It is significant to note that although there were quite a number of kinds of insects present whose habits are feeding on dead and decaying wood, no termites were found in the region. In any other regions where we have studied the insect relations to the endemic forest trees, the large termite, *Neotermes connexus* Snyder, has been found inhabiting dead branches and logs of nearly every kind of tree. Whether the elevation was higher than the natural habitat of this termite remains yet to be determined. It will be a problem of interest to ascertain just what is the upper limit in the distribution of this termite, which inhabits the native forests of all the islands, not, however, coming down onto the lowlands, though it has been found as low as about 500 feet on Oahu. It is also worthy of mention that none of the immigrant ants of the lowlands were found in the Nauhi region, nor any earwigs, nor was the widespread carpenter bee observed.

None of the large centipede was seen, but the short small lithobiid centipedes were everywhere abundant, as were also sowbugs and millipeds in rotten wood and under bark. Other animal life of interest in the region: abundance of egg-masses of Succinea snails, clear, glass-like, watery, and glistening, hanging from fern fronds in the damp koa forests; well before dusk a bat is on the wing at Nauhi; in the mamani zone a few of the Hawaiian buzzard (*Buteo solitarius* Peale) were seen on the wing or perched in trees; the native parrot-like *Loxioides bailleni* Oust. was quite abundant in the mamani trees.

The list of insects which follows gives a fair indication of the native insect fauna of the region, but much more time would be

required to make a complete entomological survey of the native forest trees growing there.

HYMENOPTERA

APIDAE

Apis mellifera Linn. Common, even far up in the mamani belt (*Sophora chrysophylla*) 8,000 feet or more elevation, where they were seen at the flowers of this tree.

HYLAEIDAE

27 **Nesoprosopis difficilis** Perkins. Collected on Sophora and Raillardia.
1 **Nesoprosopis comes** Perkins.

PEMPHREDONIDAE

1 **Nesomimesa hawaiiensis** Perkins. One female on koa at Keanakolu. Rare.

CRABRONIDAE (The fly-catching wasps))

3 **Xenocrabo polynesialis** (Cameron).
3 **Xenocrabo atripennis** (Perkins). One from cocoon in soil.
1 **Xenocrabo hawaiiensis** (Perkins).
3 **Hylocrabo tumidoventris** var. **leucognathus** (Perkins). From cocoons in rotten logs.
25 **Nesocrabo rubrocaudatus** (Blkb. & Cam.). Rather abundant. Several of its nesting sites were found. Above the highwater mark of a permanent stream in Nauhi gulch, nest holes of one to two, or possibly more cells were found under stones in black sandy soil, and one cocoon from the lot collected yielded a wasp. Three more were reared from cocoons in decayed logs. Several females were observed on a mossy little hummock of soil, excavating burrows. One of these wasps, carrying a metallic green or blue native sarcophagid fly, was captured. These flies were very abundant in the Nauhi region.

EUMENIDAE (Caterpillar-catching wasps)

21 **Odynerus peles** Perkins.
1 **Odynerus venator** Perkins.
3 **Odynerus cyphotes** Perkins.
13 **Odynerus heterochromus** Perkins.
2 **Odynerus sociabilis** Perkins.

PSAMMOCHARIDAE (Spider-catching wasps)

1 **Anoplius luctuosus** (Cress.). Not plentiful at Nauhi, 5,250 feet; also seen at 8,500 feet, and at Lake Waiau, 13,007 feet, and at the summit of Mauna Kea, 13,750 feet. At Lake Waiau, where there were a few small weeds and grass and various stray insects, a rather large active evidently diurnal lycosid (?) spider was active, and it is not impossible that the Anoplius wasp preyed upon this spider here and was not, as with most other insects, merely a wind-blown visitant to these bleak heights.

BETHYLIDAE

10 **Undetermined Sierola,** several species. Swept from several kinds of trees.

5 **Sclerodermus sp.** Collected in dead koa log. Probably parasitic on *Oodemas corticis.*

DRYINIDAE

1 **Pseudogonatopus perkinsi** (Ashm.). Swept from lehua. Probably parasitic on *Leialoha lehuae hawaiiensis.*

PROCTOTRYPOIDEA

Exallonyx philonthiphagus Williams. Nauhi gulch, Sept. 30, in an old *Acacia koa* log, 6 larvae of the staphylinid beetle *Philonthus turbidus,* apparently pupating, were found parasitized by a rather large species of this wasp. Each beetle larva had a proctotrypid pupa partly extruded from the underside of the abdomen. Several of the wasps matured.

FIGITIDAE

2 **Eucoila impatiens** (Say). Parasitic on dipterous larvae in cowdung.

4 Undetermined species.

ICHNEUMONIDAE

2 **Amblyteles koebelei** (Swezey). Common in ranch lands. Parasitic on armyworms.

2 **Amblyteles purpuripennis** (Cress.). Common in ranch lands. Parasitic on armyworms.

4 **Amblyteles** sp. (A smaller species).

3 **Ephialtes hawaiiensis** (Cam.).

1 **Diplazon laetatorius** (Fab.).

1 **Enicospilus tyrannus** Perkins. Reared from cocoon in rotton log. It had evidently parasitized a larva of *Scotorythra hyparcha,* and the larva had formed its pupal cell in the log.

4 **Enicospilus longicornis** Ashm. One from a cocoon in rotten log, and evidently a parasite of some species of Scotorythra.

7 **Enicospilus castaneus** Ashm.

1 **Enicospilus funereus** Perkins.

1 **Eremotyloides orbitalis** (Ashm.).

2 **Angitia blackburni** (Cam.). Reared from larvae of *Omiodes scotaea* on Astelia.

3 **Hyposoter exiguae** (Vier.). Reared from Scotorythra larvae on several kinds of trees.

10 **Atrometus flavifrons** Ashm. Swept from various trees.

ALYSIIDAE

6 **Aphaereta muscae** Ashm. On manure. A parasite of the puparia of the hornfly and other Diptera.

12 **Aspilota konae** Ashm.

MISCOGASTERIDAE

2 **Toxeuma sp.** Probably parasitic on *Proterhinus ferrugineus* in tree ferns.

ENCYRTIDAE

1 **Eupelmus chalcoprepes** Perkins.

PTEROMALIDAE

1 **Spalangia cameroni** Perkins. Parasitic in hornfly puparia.

EULOPHIDAE

2 **Secodella metallicus** (Ashm.).

MYMARIDAE

2 **Polynema pyrophila** Perkins. Swept from koa and lehua.

6 Undetermined chalcid-flies.

COLEOPTERA

CARABIDAE

4 **Colpodiscus lucipetens** (Blkb.).
3 **Colpocaccus hawaiiensis** Sharp. In dead stems of tree ferns.
4 **Mesothriscus hawaiiensis** Sharp.
45 **Mecyclothorax konanus** Sharp. In rotten koa logs and dead stems of tree ferns.
2 **Mecyclothorax sp.** near **vulcanus** (Blkb.). In dead stems of tree fern.
3 **Mecyclothorax sp.** near **montivagus** (Blkb.).
16 **Thriscothorax gracilis** Sharp. In rotten koa logs.
1 **Thriscothorax sp.** near **bembidioides** (Blkb.). In dead stem of tree fern.
5 **Thriscothorax variipes** Sharp. In dead stems of tree ferns.
8 **Thriscothorax karschi** (Blkb.).
5 **Metrothorax deverilli** (Blkb.). In dead stems of tree ferns and under bark of lehua.

DYTISCIDAE

1 **Rhantus pacificus** (Boisd.). Adults common in a Nauhi stream; larvae in boggy pool by trail.

STAPHYLINIDAE

1 **Philonthus longicornis** Steph. Common in cowdung.
6 **Philonthus turbidus** Erichs. Pupal cells found in rotten koa logs. A proctotrypid parasite reared from some of the larvae.
4 Undetermined staphylinids.

NITIDULIDAE

23 Undetermined specimens collected from tree ferns, lehua, Coprosma and Sophora.

ELATERIDAE

Eopenthes konae Blkb. Fragments in rotten koa log.

MELASIDAE

Dromaeolus perkinsi Sharp. Elytra in rotten koa log.
Dromaeolus obtusus (Blkb.). (?). Elytra in rotten koa log.

HISTERIDAE

1 Undetermined specimen in dead stem of tree fern.

COCCINELLIDAE

4 **Pullus kinbergi** (Boh.).
1 **Lindorus lophanthae** Blaisd.
Coelophora inaequalis (Fab.). Observed but not collected.
Cryptolaemus montrouzieri Muls. Observed but not collected.

CHRYSOMELIDAE

8 **Diachus auratus** (Fab.). On various kinds of trees.

CIOIDAE

3 **Cis porcatus** Sharp. Beaten from lehua and Coprosma.
2 **Cis cognatissimus** Perkins. Under bark of Coprosma.
2 **Cis signatus** Sharp.
12 **Cis pacificus** Sharp. In bracket fungus.
14 **Apterocis n. sp.** near **strigosus** Perkins. In bracket fungus on dead koa.

CERAMBYCIDAE

1 **Neoclytarlus claviger** (Shp.). Collected on post at Keanakolu.
10 **Plagithmysus blackburni** Sharp. Collected on dead mamani tree; larvae numerous in dying trees.
18 **Plagithmysus varians** Sharp. Mostly reared from larvae and pupae in dead branches of koa. One collected on Myoporum. One collected in cabin at Keanakolu (Ignacio).
Plagithmysus perkinsi Sharp. Larvae in dying Myoporum tree. One adult beetle issued August 21, 1932.
Plagithmysus vitticollis Sharp. Larvae found in Rubus, but none reared.
Aeschrithmysus swezeyi Perkins (?). Borings found in stems of Raillardia at 8,500 feet elevation; one larva found which failed to mature. Borings were found in Cyathodes also at the same place, which might have been by larvae of a related species.
Aeschrithmysus n. sp. Larvae found in *Vaccinium peleanum* at 8,500 feet elevation. One adult beetle matured November 27.

PROTERHINIDAE

1 **Proterhinus blackburni** Sharp.
6 **Proterhinus vulcanus** Perkins. Collected from Coprosma and dead stems of tree fern.
24 **Proterhinus ferrugineus** Perkins. Abundant in dead stems of tree ferns.
4 **Proterhinus deceptor** var. **major** Perkins. Beaten from dead branches of lehua.
3 **Proterhinus sp.** near **innotabilis** Perkins. Beaten from dead branches of Suttonia.
1 **Proterhinus** (undetermined). From Myoporum.

CURCULIONIDAE

Pantomorus godmani (Crotch). Common on various kinds of trees and plants, sometimes destructive to recently planted young seedling trees.

1 **Listroderes apicalis** Waterh. Under koa bark.

6 **Dryophthorus declivis** Sharp. In dead koa logs.

20 **Dryophthorus insignis** Sharp. In rotten koa logs and dead stems of tree ferns.

22 **Dryophthorus n. sp.** In koa and lehua logs.

3 **Pentarthrum prolixum** Sharp. In dead stems of tree ferns. Not so common as usual.

22 **Oodemas corticis** Perkins. Common in standing dead koa trunks.

11 **Oodemas n. sp.** between **chrysodorum** and **cupreum.** In pith of dead Rubus stems.

20 **Nesotocus munroi** Perkins. Collected on Cheirodendron on the Laupahoehoe trail by Joe Ignacio, the forest ranger.

PTINIDAE

3 **Xyletobius proteus** Perkins. In dead Coprosma.

LEPIDOPTERA

Unless otherwise stated, the moths of this list were taken at lights when they came very abundantly on some of the nights. Hundreds would be present at a time on the outside of the windows and the porch ceiling. An attempt was made to secure samples of all species observed. Probably the most numerous among these moths were *Scotorythra paludicola*, *Scotorythra hyparcha* and several species of Scoparia. The numbers of specimens given in the list will indicate the relative abundance of the different species.

CARADRINIDAE

2 **Hyssia compsias** (Meyr.).

2 **Cirphis unipuncta** (Haw.). Pupae were common in rotten koa logs in grassy places.

1 **Lycophotia margaritosa** (Haw.). Found under stone at 7,000 feet elevation.

1 **Euxoa baliopa** (Meyr.).

1 **Agrotis selenias** Meyr.

1 **Agrotis coniotis** Hamp.

PLUSIADAE

2 **Hypenodes altivolans** (Butl.).

HYDRIOMENIDAE

2 **Eucymatoge monticolans** (Butl.). One reared from larva but its host tree not recorded—probably Cyathodes.

SELIDOSEMIDAE

22 **Scotorythra paludicola** (Butl.). This is the moth whose caterpillars defoliated the koa trees in the forest east of Olinda, Maui, in 1926. A few caterpillars were found on the koa trees at Nauhi, but not enough to be injurious. None was reared. A few caterpillars found on Sophora might have been the same species.

1 **Scotorythra oxyphractis** Meyr.

7 **Scotorythra hyparcha** Meyr. All were males. No caterpillars of this abundant species were found. It is thought that they feed on the lehua tree. Several of their pupae were found in rotten koa logs and 2 or 3 moths reared from them. A parasite, *Enicospilus tyrannus* Perk., issued from a cocoon in one of the pupal cells where it had issued from a caterpillar of this moth.

NYMPHALIDAE

Vanessa tammeamea Esch. This butterfly was observed, and its caterpillars also observed on Pipturus. None was reared or collected.

PIERIDAE

Pontia rapae (Linn.). One butterfly seen on the wing at 8,500 feet elevation.

LYCAENIDAE

Lycaena blackburni (Tuely). A few larvae were found on new foliage of koa. None reared.

PYRAUSTIDAE

1 **Omiodes accepta** (Butl.). The common grass leafroller.

4 **Omiodes scotaea** (Hamps.). Reared from larvae on Astelia.

8 **Phlyctaenia endopyra** Meyr. The larvae found on leaves of Rubus, a very abundant shrub.

9 **Phlyctaenia pyranthes** Meyr. The larvae feed on the leaves of *Vaccinium calycinum*. There were many clumps of this shrub, and the leaves were badly eaten. None reared.

2 **Nomophila noctuella** Schiff.

3 **Scoparia balinopis** Meyr.

1 **Scoparia orthoria** Meyr.

5 **Scoparia halirrhoa** Meyr.

9 **Scoparia crataea** Meyr.

1 **Scoparia pyrseutis** Meyr.

3 **Scoparia thyellopis** Meyr.

1 **Scoparia melichlora** Meyr.

7 **Scoparia meristis** Meyr.

1 **Scoparia platyscia** Meyr.

PTEROPHORIDAE

3 **Platyptilia fuscicornis** Z.

4 **Platyptilia insularis** Walsm.

GELECHIADAE

Thyrocopa indecora (Butl.). One reared from larva in dead wood of Sophora.

DIPLOSARIDAE

Hyposmocoma chilonella triocellata Walsm. One reared from larva in pith of dead Rubus.

CARPOSINIDAE

1 **Heterocrossa gracillima** Walsm. Larva feeds in the fruits of Cyathodes.

Heterocrossa sp. Larva in terminal bud of Vaccinium. Not reared.

Heterocrossa sp. Larvae in fruits of Vaccinium. Not reared.

TORTRICIDAE

Adenoneura plicatum Walsm. One swept from Sophora. Probably the moth whose larvae feed in Sophora pods.

1 **Adenoneura montanum** Walsm.

Argyroploce illepeda fulva (Walsm.). Four reared from koa pods. The pods were found badly infested. A count was made of 87 pods, and 61% of the seeds were found to have been destroyed.

Bactra straminea (Butl.). Larvae found boring in the stems of Carex. One reared.

Archips postvittanus (Walk.). One each reared from Rubus and pumpkin vine.

Eulia sp. Larvae boring stems of Suttonia. None reared.

Epagoge infaustana Walsm. Larvae were found in terminal buds and leaves of Pipturus. None reared.

TINEIDAE

Opogona omoscopa (Meyr.). Abundant. Larvae abundant in rotten logs and other decaying vegetation.

DIPTERA

MYCETOPHILIDAE

Sciara sp. One male.

CHIRONOMIDAE

Ceratopogon sp. One female.

Tanytarsus sp. Swarms of males of this delicate green midge hovering over the water of a small stream.

PSYCHODIDAE

Psychoda alternata Say.

CULICIDAE

Culex quinquefasciatus Say. An egg-raft of this mosquito and some larvae probably of the same species found in a wooden water trough at Keanakolu. An adult heard buzzing in a cabin room at night at the same place. Larvae seen also in a spring pool at Nauhi. (Eggs of Culex have been found in a rain barrel, at an altitude of over 6,000 feet on Hualalai by the junior author, in 1929).

LIMNOBIIDAE (Crane-flies)

Adults common, probably several species.

DOLICHOPODIDAE

Medeterus sp. One male.

Campsicnemis spp. At least 4 species of water-riding flies of this family. The males have the middle pair of legs somewhat modified.

BORBORIDAE

Undetermined species on manure at 6,000 feet elevation.

LONCHOPTERIDAE

14 **Lonchoptera furcata** Fallen (?).

DROSOPHILIDAE

Drosophila sp. A large species common at a wound on a Coprosma tree at Keanakolu.

Drosophila sp. One specimen of a large species in water at Nauhi.

ANTHOMYIDAE

2 **Lispocephala dexioides** (Grims.).

Several undetermined species.

MUSCIDAE

1 **Phormia regina** (Meig.). Collected above 7,000 feet elevation.

SARCOPHAGIDAE

7 **Prosthetochaeta obscura** Grims. (?) Abundant.

OESTRIDAE

Gastrophilus intestinalis De Geer. One reared from a puparium found in horse manure at Hopuwai.

EPHYDRIDAE

Brachydeutera hebes Cress. Common on and about puddles at Nauhi. Breeding in water in an iron pot at Keanakolu.

Scatella sex-notata Cress. Breeding in the water in an exposed tree hollow at 6,000 feet at Nauhi.

Scatella hawaiiensis Grims. At creek pool at Nauhi.

Scatella wings in log water trough at Keanakolu.

HIPPOBOSCIDAE

1 **Melophagus ovinus** (Linn.). In saddle room at Keanakolu.

HETEROPTERA

CIMICIDAE

9 **Oechalia grisea** Burm. Common on lehua, koa, mamani, Coprosma, and other trees.

Coleotichus blackburniae White. Nymphs numerous on koa pods at Keanakolu (Ignacio).

GEOCORIDAE

14 **Nesocymus calvus** (White). On Carex.

Nysius spp. Four undetermined species quite common on koa, Raillardia, Sophora, and Astelia.

NABIDAE

1 **Reduviolus capsiformis** (Germ.).
9 **Reduviolus subrufus** (White). On lehua and koa.
6 **Reduviolus kahavalu** Kirk. On Sophora.

GERRIDAE

3 **Microvelia vagans** White. This minute water-strider was common on pools at Nauhi. Sometimes gathered about fallen insects.

ANTHOCORIDAE

1 **Lasiochilus denigratus** (White). In dead stem of tree fern.

MIRIDAE

1 **Hyalopeplus pellucidus** (Stal).
3 **Nesiomiris sp.** near **hawaiiensis** Kirk. On Cheirodendron.
4 **Koanoa hawaiiensis** Kirk. On lehua and Cheirodendron.
9 **Koanoa n. sp.** On Raillardia at 8,500 feet elevation.
1 **Sarona adonias** Kirk. On lehua.
28 **Tichorhinus perkinsi** (Kirk.). Very abundant on Coprosma.
45 **Tichorhinus sp.** Very abundant on Coprosma.
3 **Tichorhinus sp.** On lehua and Suttonia.
15 **Psallus sp.** near **swezeyi** Kirk. Common on Sophora.

ACANTHIIDAE

2 **Acanthia oahuensis** (Blkb.). About Nauhi streams.

POEKILOPTERIDAE

Siphanta acuta (Walk.). Common on lehua and most kinds of trees.

CIXIIDAE

2 **Oliarus kanakanus** Kirk. On lehua.
6 **Oliarus filicicola** Kirk.
2 **Iolania perkinsi** Kirk.

DELPHACIDAE

20 **Leialoha lehuae hawaiiensis** Muir. On lehua.
10 **Ilburnia koae** (Kirk.). Common on koa.
18 **Ilburnia pseudorubescens** (Muir). Common on koa.
14 **Ilburnia ipomoeicola** (Kirk.). On Sadleria and Lythrum.
27 **Ilburnia chambersi** (Kirk.). On Raillardia at 8,500 feet elevation.
12 **Ilburnia mauiensis** Muir. On Tetramolopium at 8,500 feet elevation.
1 **Ilburnia sp.** near **nesopele** Muir. On Astelia.
1 **Ilburnia sp.** On Dubautia.

CICADELLIDAE

22 **Nesosteles sp.** Common on Cyathodes.
4 **Nesophrosyne sp.** On Pipturus.
7 **Nesophrosyne sp.** On Broussaisia.
13 **Nesophrosyne sp.** On Coprosma.
5 **Nesophrosyne sp.** On Coprosma.
2 **Nesophrosyne sp.** On lehua.

PSYLLIDAE

3 **Trioza hawaiiensis** Crawfd. On lehua. Unusually scarce.

CORRODENTIA

2 **Psocus sylvestris** Perk. On Myoporum.
2 **Elipsocus inconstans** Perk. On lehua.
1 **Elipsocus psylloides** Perk. On Cheirodendron.
2 **Elipsocus criniger** Perk. On Suttonia and Sophora.
5 **Elipsocus vinosus** McLach. On Suttonia and Cyathodes.
1 **Elipsocus micramaurus** Perk. On lehua.
1 **Caecilius analis** Banks. On Cheirodendron.

ORTHOPTERA

GRYLLIDAE

Paratrigonidium sp. Several feebly-chirping crickets were heard down the Nauhi gulch.

Leptogryllus sp. A few found in tree fern stems.

LOCUSTIDAE

Oxya chinensis (Thunb.). One collected on grass down Nauhi gulch.

BLATTIDAE

5 **Allacta similis** (Sauss.). This roach which is common in hollow stems and under bark at lower elevations, was found only indoors at Nauhi, the specimens all taken in the cabin.

ODONATA

AGRIONIDAE

Agrion deceptor McLach. Rare. One male taken at 6,000-7,000 ft. elevation.

Agrion sp. Two nymphs were taken at the leaf bases of the small Astelia plants, 5,150 ft. elevation. The alimentary tract of one specimen contained what appeared to be a mite (Acari).

Agrion sp. Nymphs were common in a little stream. Stomach contents showed that they fed largely on chironomid larvae, probably Tanytarsus, and oribatid mites.

LIBELLULIDAE

Pantala flavescens Fabr. One adult observed above 8,000 ft.

Anax strenuus Perkins. Two adults seen. Nymphs reported by the forester.

NEUROPTERA

HEMEROBIIDAE

2 **Nesomicromus vagus** Perkins.
1 **Anomalochrysa hepatica** Perkins. Collected on lehua.

COLLEMBOLA

A number of these minute insects collected in and under decayed wood, etc.

Insects From the Summit of Mauna Kea

BY O. H. SWEZEY AND F. X. WILLIAMS

(Presented at the meeting of November 5, 1931)

On October 5, 1931, the ascent of Mauna Kea was made, Forest Ranger Joe Ignacio acting as guide, and the trip made from the Keanakolu ranger station at an elevation of 5,250 feet. The following insects were collected mostly at Lake Waiau, 13,007 feet elevation. Several of the flies (particularly *Chaetogaedia monticola*) were quite common at the very summit of the mountain, 13,784 feet elevation. Quite a number were found drowned in a soda water bottle which had not been entirely emptied, left by a recent visitor. Some of the specimens were in too poor condition for determination.

From Soda Water Bottle.

HYMENOPTERA

2 *Amblyteles koebelei* (Swezey).
1 *Amblyteles purpuripennis* (Cress.).
1 *Hyposoter exiguae* (Vier.).

LEPIDOPTERA

3 *Euxoa mesotoxa* (Meyr.).

DIPTERA

2 *Chaetogaedia monticola* (Bigot).
3 *Calliphora vomitoria* (Linn.).
2 *Sarcophaga haemorrhoidalis* Fall.
3 Undetermined muscids.
2 Undetermined anthomyids (?).
1 *Agromyza pusilla* Meig.
1 Myectophilid (?).
1 Chironomid (?).

HEMIPTERA

2 *Nysius delectus* White.

Others Collected Chiefly at Lake Waiau.

HYMENOPTERA

1 *Polistes fuscatus* var. *aurifer* (Sauss.). Fragments at summit.
1 *Amblyteles purpuripennis* (Cress.).
Anoplius luctuosus (Cress.). Observed at Waiau, but not caught. A spider was also noticed under stones and was probably preyed upon by this wasp.

LEPIDOPTERA

1 *Adenoneura montanum* Walsm.
1 Scotorythra (?). Fragments at summit.

DIPTERA

4 *Chaetogaedia monticola* (Bigot).
3 *Haematobia irritans* (Linn.). Perhaps came up on the horses.
1 *Phormia regina* (Wied.).
1 *Piophila casei* (Linn.).
1 *Eristalis tenax* (Linn.).
2 *Simosyrphus grandicornis* (Macq.). One at the summit.
1 *Allograpta obliqua* (Say).
1 *Brachydeutera hebes* Cress.
1 *Sciara* sp.
1 Cecidomyid (?).
Tipulids were observed at the lake, but not caught.

COLEOPTERA

1 Small staphylinid. Under stone.

HEMIPTERA

3 *Nysius delectus* White.
1 *Peregrinus maidis* (Ashm.). On surface of lake.
1 *Ilburnia pseudorubescens* (Muir). On surface of lake.
1 Green Cyathodes jassid. On surface of lake.
1 Aphid. On surface of lake.

Notes on a Small Collection of Philippine Weevils That Feed in the Fleshy Receptacles or "Fruits" of Wild Figs

BY FRANCIS X. WILLIAMS

(Presented at the meeting of July 2, 1931)

While in the Philippine Islands in 1920-1922, the writer made a study of native fig trees (*Ficus* spp.) particularly on Mt. Makiling, Los Baños, Luzon, a region notably rich in these plants. Many insects were found in more or less close association with these Ficus, being attached chiefly to their fleshy receptacles or "fruits".

Among the insects bred from, or found on, or in fig receptacles in the Mt. Makiling region were species of weevils—some of which seem to favor certain groups or types of figs rather than species of them. One or more weevil larvae may be found in a single receptacle which eventually falls to the ground. As a rule, these weevils leave the fig as full-fed larvae, pupate in the soil and issue some weeks later; it is certain, however, that other fig weevils complete their transformations within the receptacles.

A number of the Ficus were determined some years ago by Dr. E. D. Merrill, one-time director of the Philippine Bureau of Science, Manila.

Thanks are due to Dr. G. A. K. Marshall, Director of the Imperial Bureau of Entomology, London, and to Dr. K. M. Heller* of Dresden, for the determination of the collection of weevils, all from Mt. Makiling, and on which some notes are now presented.

1. **Balaninus ascendens** Heller. Reared from the furry receptacle of *Ficus xavieri* Merrill, a strangling fig, or "banyan"; Mt. Makiling, lower forest, Feb. 1921. Another specimen labelled: "examining 1/3-size fruit of *Ficus nota* (Blanco)"—"Apr. 1921"—, a dioecious tree not of the banyan type.

This weevil is blackish with a transverse and longitudinal pattern in white scales.

2. **Balaninus basilaris** Heller. Reared from the receptacle of *Ficus indica* Linn., Feb. 1921 and Nov. 1921.

* See Studien zur *Balaninini*, II, Stett. Ent. Zeit., 88, 175-287, 2 pls., 1927.

3. **Balaninus cinnamomeus** Heller. From *Ficus pubinervis* Blume (labelled *F. crassitora* Elmer) in the lower Makiling forest, March, 1921. This tree, though not of strangling habit, is monoecious.

4. **Balaninus coturnix** Heller. From the receptacles of *Ficus payapa* Blanco (labelled *F. auranticarpa*) a banyan in the lower Makiling forest, and the orange-yellow receptacles of which are covered with rather irritating, appressed whitish hairs. April, 1921. The weevil is brownish black with an extensive pattern of golden brown scales. Reported also from Mindanao, the large southern island of the Philippine group.

5. **Balaninus cruciatus** Heller. Reared from receptacles of the banyan, *Ficus camarinensis* Merrill, May, 1921. Taken also on Mindanao (Baker). The brown color of this weevil is interrupted on the elytra by a cross-like design of golden scales.

6. **Balaninus leptoclavatus** Heller. From *Ficus indica* Linn., (Jan. 1921). Taken also on Mt. Banahao, Luzon (Baker). A rather small dark weevil with a V-like pattern of white scales at the base of the elytra, and a slim white band across the elytra at their middle length.

7. **Balaninus ornaticollis** Heller. From *Ficus payapa* (labelled *F. auranticarpa*), April, 1921. Rich brown with sides of pronotum and two proximate elytral stripes, of golden scales.

8. **Balaninus varians** Heller. From the receptacles of *Ficus calophylloides* Elmer, a very large and handsome forest banyan, April, 1921.

9. **Balaninus williamsi** Heller. From the receptacle of *Ficus palawanensis* Merrill, *payapa* Blanco, *retusa* Linn., and *forstenii* Miq., all banyans or strangling figs, January, March, April, May, 1921. The beetle is blackish marked with pale scales.

10. **Balaninus (Carponinus) axillaris** Fst.; (det. G. A. K. Marshall). Reared from receptacle ("fruits") of *Ficus hauili* Blanco, *F. nota* (Blanco) and *F. integrifolia* Elmer; adult weevils also found resting on the receptacles of *F. nota*. From low elevations to 3,000 feet in the mossy forest of Mt. Makiling. These Ficus hosts are small to moderate-sized trees of non-strangling habit that bear the male and female receptacles on separate plants, as in the common edible fig of commerce. October, 1920; January, February, March, 1921.

This weevil is a large, generally light golden brown species.

11. **Metarchus latifrons** Heller. From receptacles of *Ficus indica,* December, 1930.

A compact, rather short-snouted brown weevil that apparently pupates in mummified figs instead of entering the ground to transform.

12. **Pleurotyges tagalus** Heller. From receptacles of *Ficus* (collector number 808) related to *calophylloides* Elmer. April, 1921. Also a compact brown insect.

In addition, the weevil **Phylaitis V-alba** Pasc. (det. G. A. K. Marshall) was taken resting on the stem of the lowland *Ficus ulmifolia* Lam., a small tree whose fruits are more or less edible, April, 1921.

Mecopus hopei Boh. (det. G. A. K. Marshall), another weevil with a fig-feeding facies was also collected.

Of **Balaninus bomfordi** Fst., an Indian species, H. Maxwell-Lefroy (Indian Insect Life, p. 388, 1909) says in part, ". . . the adult eats the unopened buds of the banyan tree and feeds on the inside . . ." "The larvae are found in the fleshy receptacles of the fig, which they destroy so that the fig falls off."

A large number of other fig-feeding weevils, particularly Balaninus occur in the Philippines.

Notes on Hawaiian Lepidoptera, with Descriptions of New Species

BY O. H. SWEZEY

(Presented at the meeting of December 3, 1931)

Notes are herewith presented on a few of the Hawaiian moths whose food habits have recently been discovered, or had not been previously recorded. Some of these moths are new species and are here described. Holotypes in the collection of the Hawaiian Entomological Society; paratypes, where available, in the Bishop Museum.

Family CARADRINIDAE

Aletia ferruginea n. sp. Plate 13, Fig. 1.

Male. 48 mm. Nearly uniformly ferruginous throughout, head, palpi and thorax darker; antennae ochreous, feebly serrate. Prothoracic crest slightly tipped with whitish. Thorax clothed mostly with hair and hairlike scales. Forewings elongate-triangular, costa nearly straight, termen oblique, nearly straight, tornus evenly rounded; ferruginous, with a large triangular patch with fuscous suffusion occupying a large proportion of disc, its base a little internal from mid 3/5 of costa and apex, approaching dorsum near middle; this triangular area bordered by a suffusion of white scales. An oblique wide bar of white suffusion in cell at discocellulars with a slight narrow extension basally at dorsal end. Terminal fourth of wing with some fuscous suffusion traversed by a subterminal line of white scales parallel to the termen; along termen a slight suffusion of white scales. Cilia yellowish ferruginous. Hindwings light ferruginous with a sprinkling of fuscous scales, a fuscous discal spot and postmedian fuscous line; cilia yellowish-ferruginous; under surface of both wings ferruginous tinged, the fuscous markings showing through. Thorax beneath with light ferruginous hair; legs ferruginous, the femora hairy. Abdomen uniformly light ferruginous, apical tufts the same color.

The wing markings are strikingly different from any related Hawaiian species. The venation of forewing is peculiar in that 10 arises from angle of cell; 7, 8 and 9 are stalked, arising from 10 not far from its origin, and there is no areole.

Hab.: MAUI, Olinda (Swezey). One specimen collected on the Kula pipe-line trail, June 18, 1927.

Proc. Haw. Ent. Soc., VIII, No. 1, Nov., 1932.

Euxoa giffardi n. sp. Plate 13, Fig. 2.

Male. 42 mm. Head, palpi and antennae pale brownish fuscous. Antennae slightly serrate, the serrations with fasicles of cilia. Thorax brownish fuscous, paler on the front of prothoracic crest. Forewings fuscous of various shades. Costa dark fuscous with 2 white spots before middle, and 5 beyond middle. An interrupted angulated white sub-basal line from first costal white spot; a similar line from the second costal white spot. A dentate postmedial line indicated by small groups of dark fuscous scales and a few white scales at the outer angulations. Orbicular and reniform large, outlined with dark fuscous scales. Claviform dark fuscous, wide, evenly rounded outwardly. Cilia fuscous and white mixed. Hindwings pale brown, a little darker terminally, and a slight discal bar; cilia concolorous. Legs greyish fuscous, with pale apical annulations on the tarsi. Abdomen pale brown; oval tufts ochreous.

Hab.: HAWAII, Kilauea. Collected in the dry forest, August, 1920 (Giffard).

Family PHYCITIDAE

Rhynchephestia rhabdotis Hampson, Plate 13, Fig. 4.

Hampson, Ann. Mag. Nat. Hist. (10), V, p. 52, 1930.

This moth and the work of its caterpillars have been known for a long time. Dr. Perkins collected hundreds of the caterpillars from the silversword (*Argyroxiphium sandwicense macrocephalum*) in Haleakala Crater, Maui, in 1896, which, when brought to Honolulu, failed to produce more than one or two moths. The writer collected a few of the larvae in July, 1907. Again, only one or two moths were produced, and rather indifferent specimens. In 1931 a specimen of the silversword plant from Haleakala Crater was sent in by National Park Superintendent Mr. E. P. Leavitt, and among other insects found on the plant were quite a number of caterpillars, and from these two more moths were reared. Finally Mr. Owen Bryant, of Banff, Canada, while on vacation here, spent some time collecting on Haleakala. From caterpillars collected and sent down by him, 9 moths were obtained in fairly good condition. The description by Hampson was from 2 male specimens ascribed to Terry as collector, the locality being merely "Maui," no date, and the "larva on Argyroxiphium." We are not fully aware of the circumstances of the collection of these specimens or how they reached the British Museum. Presumably they were from Haleakala Crater, as the moth is not yet known from anywhere else, or from any other plant except the silversword, and

this plant is very restricted in distribution. Besides the Haleakala station, it was formerly known on Mauna Kea, Hawaii, but is now extinct there. Of recent years it has been found on Mauna Loa, Hawaii, but there is no report of the moth or larvae infesting the plants there.

The larvae feed in the flower heads, destroying the seeds. In the seasons when there are no flowers they feed in the stem and among or at the bases of the leaves which are densely crowded together. The larvae are subject to a fungus which kills a large proportion of them. That is the main reason why so very few moths have been obtained from the larvae that have been brought down for rearing.

Homoeosoma amphibola Meyrick.

Meyrick, Fauna Hawaiiensis, I, p. 197, Pl. V, Fig. 12, 1899.

This moth was originally collected on the high plateau of Kauai above Waimea and at Kaholuamano by Perkins. Later collections were made by Kusche in 1919 and 1920 at Kokee, Kaholuamano and Waialeale. The food plant and habits were not known until the writer discovered in 1925 that it was attached to *Wilkesia gymnoxiphium*, which is an endemic shrub related to the silversword, and occurring only on Kauai, where the writer has observed it to be common in several localities, on dry slopes in the forested region at Kokee, Halemanu, Nualolo and Milolii, also in one place in the scrub near the road only a little above the upper cane fields of Kekaha Sugar Company. This plant blooms in June and July, producing a large panicle of flower heads; after ripening the seeds the whole plant dies. The larvae of *amphibola* feed on the flowers but do not injure the seeds. The larvae are so numerous that nearly every flower head is attacked. When there are no more flowers to feed on, the nearly grown larvae bore into the stem and feed on the pith, which occupies a considerable portion of the stem. The cocoons are formed within the hollowed-out stem. Some of the larvae shortly transform to pupae and then adult moths; but others remain as larvae for a long time within the cocoon and probably are able thus to carry over till the next blossoming season. None of the plants that have not reached the blossoming stage has been found attacked, nor has any other kind of plant been found attacked by this moth.

Many of the larvae die from fungus. Quite a number are parasitized by a species of Sierola.

Family XYLORYCTIDAE

Thyrocopa peleana n. sp. Plate 13, Fig. 3.

Male, female. 25-41 mm. Head and palpi white; antennae white at base, infuscated outwardly. Thorax white. Forewings nearly pure white with scattered fuscous scales, a few of which are clustered irregularly in two spots obliquely placed in cell, and two spots vertically placed at end of cell; in one male these spots are more conspicuous and the costa is black at the base. Underside suffused with light brown, cilia white. Hindwings and cilia white. Legs white, anterior femora and tibia infuscated. Abdomen white, apical tufts of male slightly ochreous tinged.

Very similar to *T. sapindiella* Sw., but twice as large.

Hab.: OAHU, Waipio ridge. 3 males and 3 females reared from caterpillars in burrows of *Nesithmysus bridwelli* Perkins, in Pelea trees, October 9, 1927 (Swezey). The larvae feed on decaying wood in the burrows, and also on the bark around the entrance, spinning a sheet of web to cover the place where feeding has taken place.

Family DIPLOSARIDAE

Aphthonetus sideroxyloni n. sp. Plate 13, Fig. 7.

Male and female. 20-23 mm. Antennae ochreous, basal segment brownish. Palpi ochreous, brownish externally. Head ochreous in front, sprinkled with brownish on vertex. Thorax brown, apex ochreous, patagia tipped with ochreous. Forewings mostly dark brown, with a whitish ochreous streak all along dorsum, this streak wider at base and expanding on termen to near apex, the boundary between brown and ochreous areas irregular. Basal half of costa and apical third has ochreous scales mixed with the brown. Near middle of wing an ill-defined circular spot with brown center; beyond this two similar semicircular spots with paler centers and a dark brown spot between them. Several raised tufts of brown scales. Cilia whitish ochreous, with a few brownish scales mixed in upper part of terminal cilia. Hindwings and cilia whitish ochreous. Abdomen whitish ochreous. Fore and mid legs with tibia and tarsi dark brown, femora paler and apex of tarsal joints pale. Hind legs whitish ochreous.

Related to *A. fluctuosa* Walsm., but the latter does not have the dorsum pale throughout.

Hab.: OAHU. Described from 9 specimens reared from larvae on leaves of *Sideroxylon sandwicense*, collected May 28, 1929, on ridge above Puu Peahinaia, Koolau Mts. The larvae fed on the under surface of the leaf protected by a frass-covered web.

Hyposmocoma latiflua Meyrick. Plate 13, Fig. 6.
Meyrick, Exotic Microlepidoptera, I, p. 344, 1915.

This species was described from a single specimen collected by Perkins in the Koolau Mts., Oahu, about 1900 or 1901. It was not rediscovered until 26 specimens were reared from larvae found by the writer feeding on leaves of *Pittosporum cauliflorum* on the ridge leading up to Puu Kalena, Waianae Mts., Oahu, December 29, 1929. The larvae were feeding singly on the under surface of the leaves beneath a frass-covered web. The upper surface of the epidermis was left intact and showed as a dead spot in the leaf. Pupation took place in a cocoon in the same place where larva fed. The pupa is brown, about 5 mm. long; the wing and antenna sheaths extend to apex of 7th abdominal segment; cremaster rounded obtuse, with 8 erect hooked bristles on dorsal part.

Family HYPONOMEUTIDAE

Mapsidius charpentierii n. sp. Plate 13, Fig. 5.

Female. 21 to 24 mm. Antennae cinereous, basal joint white. Palpi white. Head and thorax white with a sprinkling of black scales. Forewings white with numerous angulated black spots and a sprinkling of black scales; cilia at apex and termen white, brownish gray on dorsum. Hindwings brownish gray, cilia concolorous except at apex where they are tipped with white. Abdomen brownish gray with apical margins of segments white; white ventrally. Legs white, tibia and tarsi banded with black.

Male similar to female but hind wings and abdomen darker.

Similar to *auspicata* Walsm., but of larger size, and the black marks on the forewings (as shown by the figure) are more distinct and angulated. The cocoon is different, also. It is elongate spindle-shaped, densely made of white silk, placed on underside of leaf and beneath a thin lacework of silk which has several large circular meshes. This is similar to the way the cocoon of *M. quadridentata* is constructed, whereas the cocoon of *auspicata* is broad spindle-shaped beneath a closely-woven layer of white silk.

Pupa 10 mm., dark brown, lighter on the wing sheaths, which extend as far as the apex of 6th abdominal segment. Apical margin of abdominal segments with a raised rim. Spiracles of abdominal segments raised. Cremaster obtuse.

Hab.: OAHU. Described from three specimens reared from caterpillars and cocoons collected on leaves of *Charpentiera obovata*, in Mohiakea Valley, Waianae Mts., January 3, 1932, and one from Haleauau Valley, April 19, 1931.

Family TORTRICIDAE

Panaphelix asteliana n. sp. Plate 13, Fig. 8.

Male and female. 24-29 mm. Nearly uniformly light fuscous brown. Head and thorax pale brown to ochreous, palpi pale brown; antennae ochreous, the pectinations of antennae in male pale brown. Thorax with two parallel longitudinal ochreous lines, patagia ochreous. Forewings fuscous brown with ochreous lines on the veins, a roundish dark fuscous spot at end of cell; cilia ochreous, mixed with brown at base. Hindwings pale brownish ochreous, more brownish at apex and termen; cilia ochreous, mixed with brown at base. Legs ochreous, fore and mid tibiae and tarsi fuscous brown. Abdomen pale fuscous brown, apical tufts of male ochreous.

Distinct by its brownish coloration, and the lines of ochreous on the veins of forewings.

Hab.: Waianae Mts., OAHU. One male and one female reared from *Astelia veratroides*, January 22, 1929, one female February 9, 1930, all on the ridge leading up to the summit of Mt. Kaala at about 3,200 feet elevation (Swezey); one male captured at same place September 14, 1930 (Williams); two males captured near summit of Puu Kalena, April 19, 1931 (Swezey). Larvae have been brought in at other times from these places, but failed to mature.

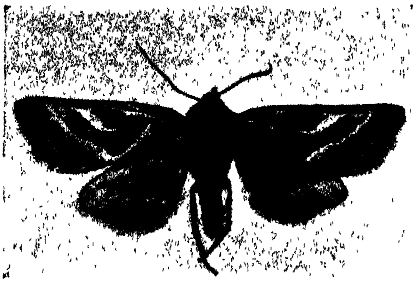
The larva is greenish with some fuscous marks on head and cervical shield. It feeds beneath web on apical part of the Astelia leaf. The leaf is partially eaten on a transverse line on lower side about 6 inches to a foot from the apex. The apical portion then bends down and is the part on which the larva feeds, eating off the under surface and leaving the extreme apical portion rolled and spun together for a retreat which eventually becomes filled with the frass.

The pupa is brown, about 15 mm. in length. The wing and leg sheaths reach the apex of the 3rd abdominal segment; the abdominal segments have two dorsal transverse rows of short spines; near the base of each abdominal segment 1 to 7 is a pair of circular dorsal pits wide apart; cremaster somewhat extended, bluntly conical with 8 hooked bristles, 4 on apical margin and 2 on each side.

Explanation of Plate 13

(All slightly enlarged)

FIG. 1. *Aletia ferruginea.*
FIG. 2. *Euxoa giffardi.*
FIG. 3. *Thyrocopa peleana.*
FIG. 4. *Rhynchephestia rhabdotis.*
FIG. 5. *Mapsidius charpentierii.*
FIG. 6. *Hyposmocoma latiflua.*
FIG. 7. *Aphthonetus sideroxyloni.*
FIG. 8. *Panaphelix asteliana.*



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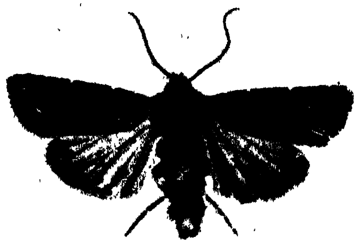

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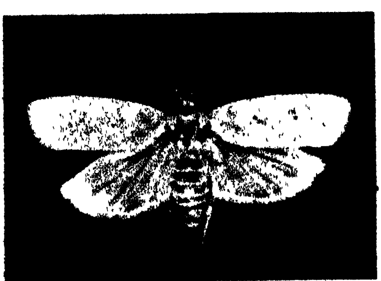

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Swezey. **Hawaiian Lepidoptera**

Exallonyx philonthiphagus, a New Proctotrypid Wasp in Hawaii, and Its Host

BY FRANCIS X. WILLIAMS

Exallonyx philonthiphagus n. sp. (Plate 14, figs. 1-4.)

♀. Length to end of ovipositor 5.10 mm. Black; tegulae yellowish brown, mandibles brown, dark at base and near apex, labrum, legs, except apex of femora and of coxae, and trochanters in part, light brown, femora otherwise rather dark brown; antennae dark brown (appearing paler in a specimen preserved in spirits), scape darkest, pedicel and first flagellar joint palest; stigma smoky brown. Head, from above, subquadrate, somewhat wider than long; smooth and polished, with pale pile, eyes sparsely pilose, distant from the posterior margin of the head by about their longer diameter, ocelli forming a rather low triangle, malar space about equal to shorter diameter of eye; frons carinate between the insertion of the antennae, anterior margin of clypeus very slightly emarginate, mandibles simple, third joint of labial palpi broadened and obliquely subtruncate at apex; antennae rather stout, a very little longer than head + thorax; 13-jointed, first two flagellar joints subequal, the first about twice as long as its greatest diameter, subsequent joints to 13th, becoming shorter and more rounded, 13th joint subacuminate at tip and at least half again as long as the 12th or penultimate. Thorax: neck transversely carinulate above and at sides, mesothorax narrowed in front, the sides concave; scutum smooth and polished, impression at base of scutellum deep; metanotum foveate; pro- and mesopleurae smooth and polished, posterior margin of mesopleurae foveate; metapleurae strongly reticulate. Propodeum: a broad smooth space on each side of the median carina, passing over into strongly reticulate sculpture behind and at the sides; femora stout, the anterior ones particularly so, longer metatibial spur less than half as long as the metatarsus. Wings clear; costal, subcostal and submarginal veins brown; stigma brown; marginal cell a little more than half as long as stigma, other venation represented by glassy folds or ridges. Abdomen: petiole, above, broader than long, its basal angles prominent, the apical end rounded-angulate; sculpture rather coarse and irregular; beneath transversely wrinkled except apically, where it is longitudinally parallel-grooved; longitudinal grooves at base of abdomen above, increasing in length mesially. Ovipositor finely longitudinally aciculate, hardly as long as the hind metatarsus.

Type, ♀, and 1 ♀ paratype (lacking part of abdomen and wings); and a ♂ and ♀ pupa, all in the collection of the Experiment Station, Hawaiian Sugar Planters' Association. A ♀ also deposited with Professor C. T. Brues, Department of Entomology, Harvard University. All were reared from larvae of the staphylinid beetle *Philonthus turbidus* Erichson, secured at Nauhi, Hawaii, 5,250 feet elevation, October, 1931. This wasp, judging from Ashmead's table and description (Monograph of the North

American Proctotrypidae, Bull. 45, U. S. National Museum, p. 335, and pp. 343-344, 1893), and from Brues' table (Jour. New York Entom. Soc., XXVII, pp. 9-11, 1919), is certainly closely related to *Exallonyx quadriceps* (Ashm.) from the Eastern United States and which is apparently a smaller species with slightly paler appendages; it seems also related to the European *Exallonyx ater* (Nees), (see Morley, C. A Synopsis of British Proctotrypidae (Oxyura); The Entomologist, 55, 1922, on pp. 159-160, and 183).

On September 30, 1931, while studying the insects of decayed tree trunks with Mr. O. H. Swezey, at Nauhi Forest Nursery, on the moist slopes of Mauna Kea, Hawaii, at an elevation of 5,250 feet, 6 larvae of the staphylinid beetle *Philonthus turbidus*, each with an Exallonyx wasp pupa protruding from its abdomen, were found. The fallen trunk of an *Acacia koa* Gray, from which 5 of the specimens were secured, was much decayed and its hollowed upper surface contained soil-like material besides the disintegrated wood. A near-by log yielded the sixth Exallonyx. In some cases, at least, the parasitized Philonthus larva lay in a cell. Five of these bore a female wasp pupa, each of which protruded for half its length or more from the venter of its host's abdomen and towards which it could bend the body. The single male pupa protruded somewhat less than one-third its length from the host. The one bearing the male pupa (Fig. 4) had evidently been quite near pupation at the time of attack by the wasp, for its head capsule was split above and below, and the pro- and mesonotum were also cleft, as occurs when the skin is about to be shed to release the pupa. A second parasitized Philonthus, likewise with the thoracic plates divided, had the posterior portion of the body hollowed out by the wasp grub, while the anterior portion, little eaten of, enclosed head and thorax, already more or less chitinized, of the next or pupal stage of development. Other parasitized larvae did not show these signs of moulting, but all appeared to have reached their maximum growth. It seems reasonable to suppose, therefore, that *Exallonyx philonthiphagus* attacks only those Philonthus larvae that, because of nearness to the quiescent or pupal stage, are comparatively helpless; the feeding Philonthus larva is active, carnivorous, and armed with sickle-like jaws and would then seem too strong an antagonist. It is evident that the

Exallonyx larva feeds within the body of its host and when the time for pupation is at hand breaks through the venter and pupates partly extruded—as figured. Here one sees that in the female pupa, the antennae are stretched along the underside of the body (Fig. 1), while in the male they are bent back on the head with somewhat of a ram's horns effect.

The single male pupa, showing signs of dissolution, was preserved in alcohol together with a female pupa. The remaining 4 Exallonyx pupae successfully transformed into shining black wasps about 5 millimeters long and with the legs largely brownish. Unfortunately, 2 of these wasps were enclosed in a vial containing a *Philonthus turbidus* pupa, that, hatching into a beetle, mutilated and partly devoured its wasp foes. The pupa of this beetle is comparatively stout, yellowish brown, well chitinized and with the appendages immovable.

Philonthus turbidus (Erichson, W. F., Genera et Species Staphylinorum, Berlin, p. 484, 1839-1840), is widespread in the Hawaiian Islands, and M. Bernhauer and K. Schubert, in W. Junk's Catalog of Coleoptera, Staphylindae, p. 358, 1914, give its world distribution as: Canaries, Madagascar, Hawaii, Morocco, Egypt, Maderia, Syria, and South Russia.

Few hosts of the genus Exallonyx appear to be known. In Great Britain, F. W. Frohawk bred 9 individuals of *E. ater* (Nees) from a single larva of *Creophlius maxillosus* (Lec.), a large stout and common staphylinid beetle. The wasps issued from pupae that protruded from the underside of the defunct beetle larva. (Frohawk, *Proctotrypes ater* from larva of *Creophilus maxillosus,* The Entomologist, p. 225, 1886, Fig.). Sharp, in Cambridge Natural History of Insects V, p. 535, 1895, shows in Fig. 352 the "Pupation of *Proctotrypes* sp. in body of a beetle larva," said beetle larva greatly resembling one of the Stapylinidae, and from the underside of which over a dozen of the wasp pupae are protruding. In genera related to Exallonyx, the North American *Cryptoserphus obsoletus* (Say) has been reared by Prof. Comstock in 1879 from the larva of *Stelidota strigosa* (Gyll.), a beetle of the family Nitidulidae (See Ashmead Bull. 45, U. S. Nat. Mus., p. 340, 1893); while the European *Paracodrus apterogynus* (Haliday) has been bred by K. Zolk from the Larva of *Agriotes obscurus* L., an elaterid beetle (Zur Biologie von *Paracodrus*

apterogynus Halid. Tartu Ülikooli Ent-katsejaama teadaanded Dorpat No. 5, 1924, 10 pp., 6 figs.). It seems probable that this was the wasp species "the destroyer of the wireworm" bred by Wm. Kirby and so recorded in 1859, and by Curtis. (See Morley, The Entomologist, p. 55, 1922.)

Several species of the genus Proctotrypes in Europe are known to parasitize the larvae of carabid and staphylinid beetles and of certain diptera, while *P. calcar* Haliday has been reared by Newman from the centipede *Lithobius forficatus*, 21 of the wasp pupae protruding from its neutral side (Newman, E., The Entomologist, pp. 342-344, 1867). For the classification and data on the biology of European Proctotrypidae, see Claude Morley (A Synopsis of British Proctotrypidae (Oxyura), The Entomologist, 55, pp. 1-3, 59-60, 82-83, 108-110, 132-135, 157-161, and 182-186).

H. Maxwell-Lefroy, Indian Insect Life, p. 168, 1909, states that an Indian species of Proctotrypidae was reared from a beetle larva.

Proctotrypes hawaiiensis (Ashmead, Fauna Hawaiiensis, I, Pt. 3, pp. 294-295, 1901), a wasp with the head transverse, is the only other proctotrypid recorded from the Hawaiian Islands, where it has been taken by Dr. R. C. L. Perkins and others at suitable elevations in the mountains.

EXPLANATION OF PLATE 14

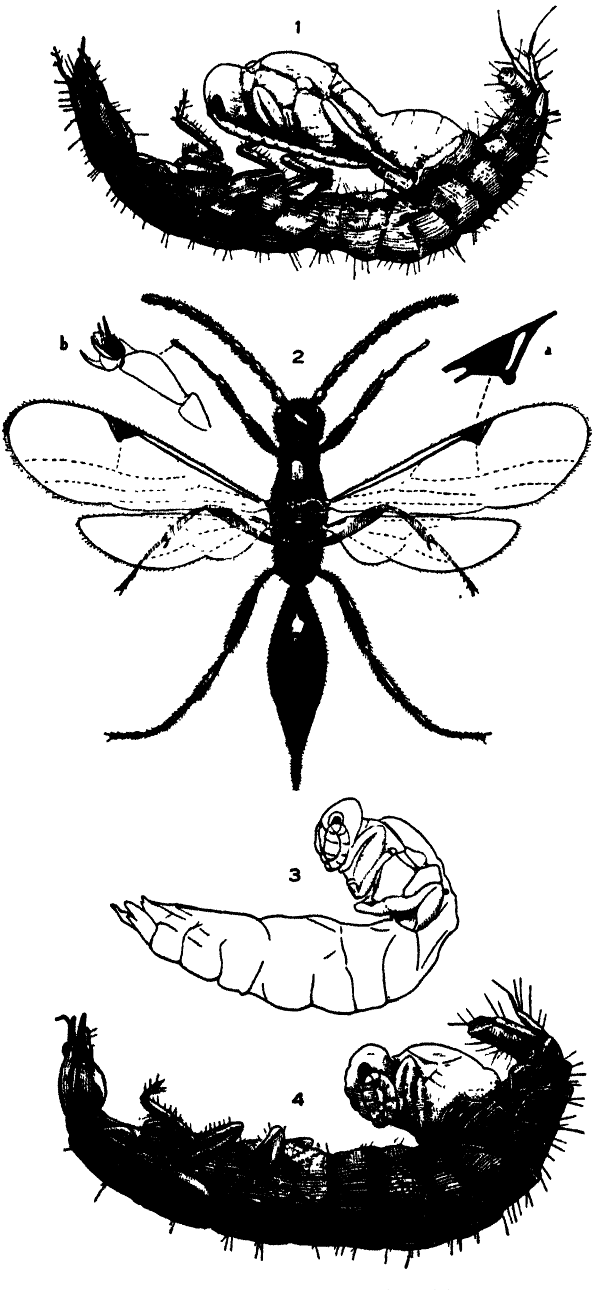
(All figures enlarged 11 diameters, except 2a and 2b highly enlarged)

1. Larva of the staphylinid beetle, *Philonthus turbidus*; with the female pupa of the wasp *Exallonyx philonthiphagus* protruding from the underside of its abdomen.

2. Adult wasp, *Exallonyx philonthiphagus* type; female; a, stigma and marginal cell of wing; b, last two tarsal joints and claws of foreleg of paratype.

3. Male pupa of the wasp *Exallonyx philonthiphagus* dissected from body of its host, *Philonthus turbidus*.

4. Larva of *Philonthus turbidus* showing male pupa, of fig. 3, of the wasp in position.



Williams. **Exallonyx philonthiphagus**

Records of Immigrant Insects for 1931

BY THE EDITOR

The following immigrant insects are recorded in this issue for the first time as occurring in Hawaii. Some of them have been previously known to occur here, but had not been identified, and their names are now recorded for the first time. Those marked with an asterisk were observed for the first time in 1931. For details of records, etc., refer to the pages given.

PROCEEDINGS

OF THE

Hawaiian Entomological Society

VOL. VIII, NO. 2 FOR THE YEAR 1932 OCT., 1933

JANUARY 7, 1932

The 312th regular meeting of the Hawaiian Entomological Society was held at the Experiment Station of the Hawaiian Sugar Planters' Association on January 7, 1932, at 2:30 p.m.

Members present: Messrs. Bianchi, Bryan, Carter, Chapman, Chock, Ehrhorn, Fullaway, Hagan, Illingworth, Ito, Keck, Marlowe, Mason, McBride, Pemberton, Olsen, Rosa, Sakimura, Smith, Swezey, Van Zwaluwenburg, Watt, Weinrich, Willard and Williams.

Visitors: Messrs. Blackman, Schmidt, Solander, Volck and Dr. Woltereck; Miss Dobroscky and Miss Suehiro.

President Chapman called the meeting to order.

The minutes of the preceding meeting were read and approved.

Mr. Fullaway stated that he had audited the Society's accounts for the year 1931, and found them to be correct.

The members of the Society and the visitors then went out in the grounds where a group photo was taken, then returned to the meeting room.

Mr. Swezey presented to the Society a picture of the staff of the H.S.P.A. Experiment Station for 1907, with the entomologists especially designated. Mr. Ehrhorn also presented a photograph of some entomologists.

Messrs. G. V. B. Herford, J. S. Phillips and Carl T. Schmidt were duly elected to Junior membership.

PAPERS

Dr. Carter reviewed a paper (to be published alsewhere) relating to the measuring of pineapple mealybug populations in the field and determination of their migration in from the edge of the

field. A considerable discussion re ants and mealybugs, ant traps, etc., followed.

President Chapman, having a business engagement, now turned over the meeting to Vice-President Hagan and the meeting continued.

Mr. Bryan introduced Dr. R. Woltereck, of the University of Leipzig, who is particularly interested in the small crustacea of fresh water (Entomostraca, Genetics of Cladocera). Dr. Woltereck made a brief statement of his work, which is genetical and ecological in character. He is going to the Orient and farther east to study lake faunas, etc.

NOTES AND EXHIBITION OF MATERIALS

**Cecidomyid from hibiscus buds.*—Mr. Swezey exhibited specimens of an undetermined cecidomyid reared from larvae in flower buds of hibiscus collected in the grounds of Mr. J. W. Waldron, Nuuanu Avenue, Honolulu, November 19, 1931. The buds had all fallen from a few bushes before opening, so that no flowers were being obtained. The adults began issuing December 4. On December 1, Mr. Swezey found infested buds on a hibiscus in his own garden in Manoa, from which adult midges issued December 19. He has searched for infested buds in other parts of the city, but to date had found none except in these two places. This is the first record of this immigrant insect in Honolulu. Specimens will be sent away for determination.

Hierodula patellifera (Serv.).—Mr. Swezey exhibited a specimen of this mantid which had recently been identified by Mr. Morgan Hebard of the Philadelphia Academy of Sciences. This mantid is the one recorded in Proc. Haw. Ent. Soc., VI, p. 11, 1925, as having been received from Waimea, Kauai, April 1, 1924. No more specimens have yet been collected, so far as known. The species occurs in Java and the Philippines.

Platyptilia brachymorpha Meyr.—Miss Suehiro reported that this pterophorid moth, which was identified by Mr. Swezey as *Playptilia brachymorpha* Meyr., was found quite numerous on ornamental snapdragon buds. This species has not been reported

* *Contarinia maculipennis* n. sp., described by Felt on page 247 of this issue. [Ed.]

from Oahu since Perkins captured it on Waialua beach in 1892. This is the first record of any food plant.

Hydrophorus sp.—Dr. Williams exhibited a specimen of this fly (Dolichopodidae) and its pupal shell. It breeds in the lowland mud flats, the larva feeding upon various dipterous larvae, while the adult was observed pulling blood-worms (Chironomus) out of watery mud, and holding them with forelegs and mouth, devouring them. The larva forms a cocoon and the pupa is extruded to disclose the adult. The adult fly skates on the water.

FEBRUARY 4, 1932

The 313th regular meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., on February 4, 1932, at 2:45 p.m.

Members present: Messrs. Bryan, Ehrhorn, Herford, Mason, Rosa, Schmidt, Swezey, Van Zwaluwenburg and Williams.

Visitors: Miss Dobroscky and Miss Suehiro.

In the absence of both the President and the Vice-President of the Society, Mr. E. M. Ehrhorn was chosen President pro tem.

The minutes of the previous meeting were read, corrected and approved.

Mr. Swezey, of the Photographs-of-Entomologists Committee, showed the three photos taken at the previous meeting of the Hawaiian Entomological Society and stated that they were ready for selection by members and suggested that they be paid for from the treasury of the Society. Mr. Van Zwaluwenburg suggested that the Society should keep a set of these three group pictures.

NOTES

Copris incertus var. *prociduus* (Say.).—Mr. Swezey reported that Mrs. Thompson, a science teacher at Punahou, last December 14, 1931, brought in for determination a specimen of this beetle which a pupil had collected at University Avenue. This would indicate that the beetle has become established on Oahu from small colonies that were liberated in the Punahou pasture, September 24 and October 27, 1930. It is the first recovery on Oahu, so far as known.

MARCH 3, 1932

The 314th regular meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., on March 3, at 2:35 p.m.

Members present: Messrs. Bianchi, Bryan, Ehrhorn, Fullaway, Hagan, Herford, Illingworth, Keck, Mason, Mitchell, Olsen, Rosa, Schmidt, Smith, Swezey, Van Zwaluwenburg, Weinrich, Wilder, Williams.

Vsitors: A. M. Adamson, Lex Brodie, O. Bryant, Dr. Irene D. Dobroscky, N. H. Krauss, W. F. Robertson, W. H. Volck and Dr. H. Yuasa.

The meeting was called to order by Vice-President Hagan.

The minutes of the preceding meeting were read and approved.

Photograph Committee.—Mr. Swezey circulated samples of the latest group photos of the Society for the signature of those who wanted the photographs. Mr. Ehrhorn on behalf of Mrs. W. M. Giffard presented the Society with an old photo that included Mr. A. Koebele, and another picture of Dr. F. A. G. Muir.

Dr. Gerrit P. Wilder presented the Society with a nearly complete set of the Fauna of Samoa.

PAPERS

Mr. Swezey on behalf of Dr. E. P. Felt presented a paper on **"A Hibiscus Bud Midge New to Hawaii."**

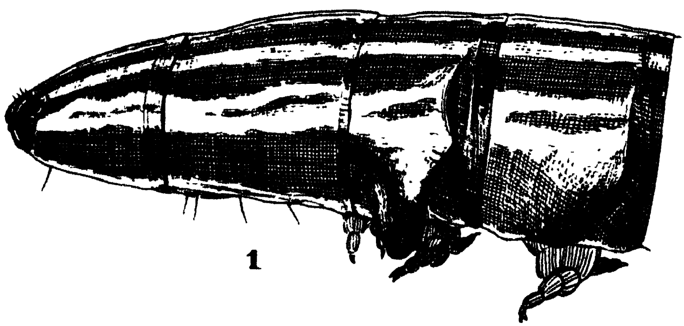
NOTES AND EXHIBITIONS

Mr. Adamson of the Pacific Entomologcal Survey spoke on the genus Rhyncogonus as represented in the Marquesas Islands. He exhibited material.

Mr. Bryant spoke of collecting insects for three summers in the Canadian Arctic. The eastern and the western faunas, probably with James Bay as a separator, were different.

Dr. Yuasa, of the Kyoto Agricultural College, spoke of entomological work in Japan, gave an interesting synopsis of some of the entomological journals there. Konshu = Insecta. Mushi = vernacular name for insect, "bug."

Prothetelous elaterid larva.—A prothetelous larva of *Simodactylus cinnamomeus* (Boisd.) from the H.S.P.A. collections, was exhibited by Mr. Van Zwaluwenburg. The specimen was taken in March, 1911, in cow dung at Grove Ranch, Maui, and is predominantly larviform with a carrying back of pupal characters into the larval stage. Fairly well developed wing-buds occur on the second thoracic segment, and less well developed ones on the third. In addition, the armature of the terminal abdominal segment is strongly reduced and simpler than in the normal larval condition, and seems to represent an approach to the terminal structure of the pupa. This is the second local case of prothetely in elaterids, Dr. F. X. Williams in 1925 having reported and figured a prothetelous *Monocrepidius exsul* Shp. (Proc. Haw. Ent. Soc., Vol. 6, p. 211).



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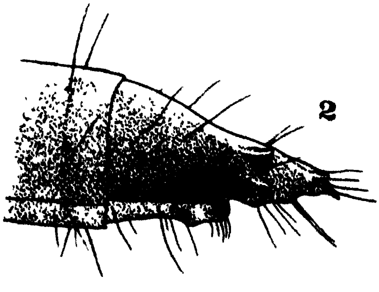

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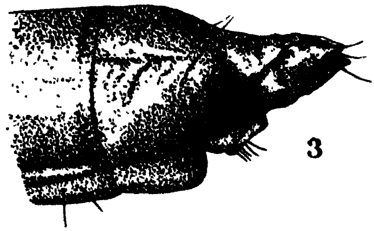

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Prothetelous larva of *Simodactylus cinnamomeus.*

1. Anterior end, lateral view.
2. Normal larva, posterior end, lateral view.
3. Prothetelous larva, posterior end, lateral view.

Mr. Swezey exhibited a collection of insects collected by himself and Dr. Williams in September and October, 1931, at Nauhi, Keanakolu and the higher slopes and summit of Mauna Kea, Hawaii.

Plagithmysus muiri Perkins.—A fine specimen of this endemic cerambycid beetle was exhibited by Mr. Swezey. It had just matured from a larva found in a Sideroxylon tree in Mohiakea Valley, Waianae Mts., January 3, 1932. It is the first time this beetle has been secured since its original rearing from a Sideroxylon tree in Haleauau Valley, November 11, 1926.

Plagithmysus kuhnsi Perkins.—A fine specimen of this beetle was also exhibited by Mr. Swezey. It had recently matured from a larva found in Pipturus tree in Haleauau Valley, Waianae Mts., January 3, 1932. Dead Pipturus trees are considerably bored by the larvae of this beetle in that valley, but the beetle is seldom reared.

Sympherobius barberi Banks.—Mr. Fullaway reported that Nathan Banks of the Museum of Comparative Zoology at Harvard College, Cambridge, Mass., has determined the lace-wing fly introduced several years ago from Mexico to be this species. The insect has been reared in large numbers and liberated at various places, principally in pineapple fields, but though it has been recovered on several occasions its establishment is still somewhat uncertain.

Melanoxanthus melanocephalus (Fabr.).—Mr. Van Zwaluwenburg mentioned that in the H.S.P.A. Experiment Station collections is a specimen of this species, hitherto known locally only from Oahu, which was taken May 28, 1930, by Mr. O. H. Swezey at Olowalu, Maui. A new record of distribution.

APRIL 7, 1932

The 315th regular meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., on April 7, 1932, at 2:35 p.m.

Members present: Messrs. Adamson, Bryan, Carter, Chapman, Ehrhorn, Fullaway, Hagan, Herford, Illingworth, Ito, Keck, Mason, McBride, Mumford, Olsen, Rosa, Smith, Swezey and Van Zwaluwenburg.

Visitors: Lex Brodie, Dr. Irene Dobroscky, J. d'A. Northwood, Miss Amy Suehiro and Dr. Hachiro Yuasa.

The meeting was called to order by President Chapman. In the absence of the regular Secretary, Dr. Hagan was appointed as Secretary pro tem.

The minutes of the preceding meeting were read and approved, as corrected.

Photograph Committee.—Mr. Swezey passed group photographs again for orders from members.

Mr. Ehrhorn contributed photos of Dr. F. Muir and of several others.

Mr. Bryan suggested that a photograph of Dr. N. A. Cobb be added to the collection of photos of Hawaiian Entomologists. He had a photo.

Mr. Van Zwaluwenburg moved to approve sending "Proceedings" to Kyoto and Dr. Yuasa. The motion passed. Mr. N. H. Krauss was elected to Junior membership.

Mr. Henry Holmes, an attorney, submitted his resignation. Mr. Swezey spoke briefly of Mr. Holmes' history and connection with the Entomological Society. Mr. Fullaway moved to accept the resignation and to write a letter expressing appreciation of his past support. Passed.

Dr. Yuasa presented three books to the Society, as follows:

Manual Applied Zoology.

Illustrated Manual of Japanese plants, and a book on the Lepidoptera of Japan. Mr. Van Zwaluwenburg moved to accept these books with thanks. Passed.

Mr. Swezey discussed the problem of contributing "Proceedings" to sugar plantation managers (about 40). He moved that managers be informed that sets are available if they want them. Passed, and the Secretary was instructed so to inform them.

EXHIBITION OF, AND NOTES ON LOCAL MATERIAL

Plagithmysus cuneatus Sharp.—A specimen of this beetle was exhibited by Mr. Swezey, which had matured from a larva brought in March 20, from Niu Valley, where larvae were found by himself and Dr. Williams quite abundant in dying branches of *Sapindus oahuensis* trees. Several of the trees were found along the

trail that follows along the ewa side of the ridge that occupies the middle of the valley. They all showed exit holes of the beetle. Nine larvae and one pupa were collected from beneath bark, and about as many injured at the same time. The pupa died. One larva pupated March 21; 8 were put in holes in blocks of wood. The pupa became adult April 1, and took five days to become fully hardened and colored up. This is the first time that this beetle has been reared from its host tree. Three beetles had been collected by Forbes from this tree in Wailupe Valley in 1917. The first collecting of this species was by Dr. Perkins in the Waianae Mts. in 1893, but he did not know the tree from which they were collected.

Nausibius clavicornis (Kug.).—A specimen of this cucujid beetle was exhibited by Mr. Swezey, who had collected it under decaying bark of *Sapindus oahuensis* growing on Niu Ridge, March 20, 1932. This beetle was collected originally by Mr. Blackburn, and was said to be common in Honolulu. However, there are no records of it since Blackburn's collecting and this was the first time Mr. Swezey had taken it.

Margaronia cyanomichla Meyr.—A specimen of this pyraustid moth was exhibited by Mr. Swezey, who had reared it from a small larva on leaf of *Pseudomorus brunoniana,* Haleauau Valley, Waianae Mts., Oahu, March 13, 1932. The larva pupated March 25, 1932, and the moth issued April 5. This is the first discovery of the native host plant of this moth. The only previous rearing was from cultivated mulberry in the grounds of the Catholic Boys' School, Hilo, Hawaii, August 23, 1912.

Anagyrus saccharicola Timberlake.—Mr. Swezey reported that this encyrtid parasite on the pink sugar cane mealybug, introduced from the Philippines in 1930, has lately been found established and spread to all extremes on Ewa Plantation, Oahu Sugar Company and Honolulu Plantation. He had also found it established at Mapulehu, Molokai, April 4.

{*Diomus margipallens* (Muls.)
}*Scymnus pictus* Gorh.—Mr. Swezey reported that in March a few specimens of these ladybeetles were found in various fields of Ewa Plantation. They were introduced from Mexico in 1930

by the Board of Agriculture as enemies of the pineapple mealybug. They are thus now found to have taken to the cane mealybug.

Cryptorhyncus mangiferae (Fab.).—Mr. Swezey reported the collecting of one of these weevils on a fallen mango at Mapulehu, Molokai, April 4, 1932. He also found small larvae in seeds of fallen mangoes at Kawela, Molokai, the same day. These are the first records of the mango weevil on Molokai. It has been known on Oahu, Kauai, Maui and Hawaii for a long time.

Ceromasia sphenophori Vill.—Mr. Swezey reported finding the New Guinea tachinid parasite of the sugar cane borer in cane field at Mapulehu, Molokai, April 4, 1932. Apparently it had not previously been reported from that island.

Cryptotermes piceatus Snyder.—Mr. Bryan exhibited a framed picture so infested by Cryptotermes that even part of the print had been consumed.

Camponotus maculatus F. race *mitis* Sm., var. *hawaiiensis* F.—Mr. J. d'A. Northwood presented the following observations on this ant: Nest found about February 26, identified as above by Mr. E. H. Bryan. March 7, one queen, about six soldiers and a dozen winged immature queens and perhaps a hundred workers. Unable to find small slender males. About 75 pupa cases of varying sizes. No larvae. Workers tearing open pupae cases and eating pupae, also eating wings off living immature queens. Queen not laying.

April 3. Diluted honey acceptable, also cockroaches which they refused a week or two ago. This they take into nest and devour. When taking honey abdomen swells noticeably and on return to nest they feed the others. All pupae have now emerged (or been eaten) and last week a cluster of eggs arrived. More active in evenings.

Sting? When alarmed, abdomen is curled forward between legs until tip is presented to front. Also when alarmed they twitch strongly. Sight very poor, though eyes prominent.

Mr. E. M. Ehrhorn reported on the beginning of flights of termites. He said they are coming out earlier in the day this year than in the past.

EXHIBITION OF, AND NOTES ON FOREIGN MATERIAL

Mr. Bryan exhibited part of a collection of insects made by Professor F. L. Washburn of the University of Minnesota, in the Society and Marquesas Islands, 1922-1923 and 1925-1926. The specimens were sent to B. P. Bishop Museum for identification.

Mr. E. P. Mumford gave an example of *discontinuous geographical distribution in the Marquesas,* as follows:

Cyphogastra bedoci Théry (1926), a buprestid beetle at present thought to be endemic to the Marquesas and there restricted to the islands of Uapou and Fatuhiva.

In a MS. to be published shortly in the Pacific Entomological Survey Series, K. G. Blair of the British Museum distinguishes three varieties: *C. bedoci,* the typical form from Uapou. *C. bedoci* var. *obscura* from Fatuhiva, *C. bedoci* var. *cyanescens* from an unknown locality. Large series of the first two were taken by the Pacific Entomological Survey, the third variety *cyanescens* has been described from a few specimens submitted to the British Museum by Mr. Ahnne of Papeete.

The three forms vary in puncturation, coloration, apical spines, etc. They all show considerable variation in size, from 24-37 mm.

In Uapou, *C. bedoci* is known by the natives as *he*. In the other islands, the name is used to denote the stick insect, *Graeffea crouanii* (Le Guillou), commonly found on coconuts.

It commonly occurs on *taie, Terminalia catappa* (Combretaceae). This tree is widely distributed in the old-world tropics.

MAY 5, 1932

The 316th regular meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., on May 5, 1932, at 2:35 p.m.

Members present: Messrs. Adamson, Bryan, Bianchi, Carter, Chapman, Ehrhorn, Fullaway, Hagan, Illingworth, Keck, Krauss, Mason, Mumford, Olsen, Rosa, Schmidt, Smith, Swezey, Van Zwaluwenburg, Weinrich, Wilder and Williams.

Visitor: Miss Dobroscky.

President Chapman called the meeting to order.

The minutes of the preceding meeting were read and approved.

Mr. Swezey, representing the photo committee, distributed to members the latest photographs of the Society.

The Secretary-Treasurer brought up the question of membership dues; where the member was elected, for example, during the second, third or fourth quarter, should he pay full dues for that year, or only in proportion? Considerable discussion ensued. Dr. Illingworth then made a motion that the year of election be divided into quarters and that the member involved pay accordingly; 25 per cent for each quarter. Seconded.

More discussion; then a simplifying amendment was offered as follows: "that the payment of dues for the year of election be made on a semi-annual basis, full dues if elected on or before June 30th, or half dues if elected after June 30th." Seconded by Mr. Van Zwaluwenburg. Carried. Then original motion carried.

Dr. Hagan moved that the Hawaiian Entomological Society appoint Dr. Walter Carter as its delegate to the Fifth International Entomological Congress to be held at Paris in July, 1932. Seconded by R. H. Van Zwaluwenburg and passed. The President then instructed the Secretary to write credentials for Dr. Carter.

NOTES AND EXHIBITION OF LOCAL MATERIAL

Mezium americanum Lap.—Mr. Swezey exhibited specimens of this ptinid beetle which had been handed to him by Dr. H. L. Lyon, March 14, 1932. They were said to have been found among stored seeds at the Vineyard Street Nursery. Specimens had been submitted to Dr. E. C. Van Dyke at the University of California, who replied that they agreed with their *Mezium americanum*. This is the first record of the identity of this beetle in Hawaii, but it had been collected previously by Bridwell in sparrow nests in 1916 (Proc. Haw. Ent. Soc., III, p. 288, 1917), and by Swezey in dried sunflower heads in 1912.

Hyposmocoma alliterata Walsm.—Mr. Swezey exhibited a specimen of this tiny white black-spotted moth bred from larval case on bark of kiawe tree collected at Ewa coral plain, April 13, 1932. The larval cases were quite common on the trees in the region. It is the first time it has been known to occur at such low elevation. It most commonly occurs on the bark of koa trees, as on Mt. Tantalus and similar elevations.

Anagyrus saccharicola Timb.—Mr. Swezey reported that he had recently received Mr. Timberlake's MS.* description of this mealybug parasite. He also reported that it had been found established and widely dispersed in the plantations on the north side of Oahu and also the west side, now making a complete dispersal on Oahu.

Conoderus exsul (Sharp).—Mr. R. H. Van Zwaluwenburg called attention to the general acceptance by most authorities of the generic name Conoderus for the elaterid beetles commonly known as Monocrepidius. These genera were established by Eschscholtz in Thon's Entomologisches Archiv, Vol. 2, part 1, in 1829, Conoderus on page 31 and the other on the following page. The type of Conoderus is defined as having the prothorax long and conical, and the apex of the elytra bispinose; in Monocrepidius the prothorax is wide, and the tips of the elytra are without spines. Perhaps a monographic study of the some 350 species involved would result in both genera being valid, and in the definition of additional genera. From our present knowledge of the species-complex the common immigrant Monocrepidius in Hawaii, with the tips of its elytra often terminating in short but well-defined spines, should be known as *Conoderus exsul* (Sharp).

Cosmophila vulpicolor Meyr.—Dr. Williams mentioned that he had collected a large larva of this noctuid moth that was feeding on the rosaceous plant *Osteomeles anthyllidifolia* Lindl. near Naalehu in the Kau desert of Hawaii, in April, 1932. The caterpillar spun a cocoon and pupated but failed to hatch. Heretofore this insect has been found only on Molokai and Oahu.

Epitritus wheeleri Donisthorpe.—In collecting insects in the old pahoehoe lava area south of Olaa village, Hawaii, in April, 1932, Dr. Williams found several kinds of ants, including a specimen of *Epitritus wheeleri*, a tiny species with long slender mandibles. It was first found here at Waimanalo, Oahu, in June, 1932, by Mr. O. H. Swezey. Also at Olaa, were taken some specimens of a tiny ant new to the islands.† It seems to belong to the genus *Strumigenys*, subgenus *Cephaloxys* F. Smith that has shorter, fine-toothed mandibles than our *Strumigenys lewisi* Cam., but like it

* Published in Proc. Haw. Ent. Soc., VIII, No. 1, p. 159, 1932.

† *Strumigenys membranifera* Emery, var. *williamsi*. Identified by Dr. W. M. Wheeler. See pages 275-276 in this issue.—[Ed.]

is hypogaeic, though in larger colonies. The ants were found under moss on lava stones, under the latter or in the soil at the base of grass. The destructive *Pheidole megacephala* ant was not found in this district.

Anagyrus saccharicola Timb.—Dr. Williams also reported that the Philippine encyrtid parasite of the pink sugar cane mealybug was found established on all five of the sugar plantations on Maui (April, 1932).

Melanoxanthus melanocephalus (Fabr.).—A specimen of this elaterid beetle was taken on the lanai (porch) of the Hilo Hotel, Hilo, Hawaii, in April, 1932, by Dr. Williams. This is the first record of this beetle on the Island of Hawaii.

Stenomicra, apparently *angustata* Coq.—Dr. Williams exhibited a small, rather slender pale yellowish brown fly of the family Geomyzidae, determined by Dr. J. M. Aldrich as *Stenomicra* species apparently *angustata* Coquillet, an insect described from Puerto Rico, in 1900. The genus is monotypic. This agile fly may sometimes be seen in the cane fields of Hawaii, it having the habit of retracing its steps and moving backwards on a leaf, and calls to mind thereby some of the small pale-colored chalcid wasps. The specimen in hand was reared from one of two larvae secured by Mr. O. H. Swezey from the water-filled leaf base of Job's Tears (*Coix lacryma-jobi* Linn.). The larva has a small head and a forked caudal end and is quite flattened (depressed) and moves in an undulating manner, somewhat caterpillar-like, and is aided by prolegs. It is glassy-white except for gut, or glands. On one occasion one of the larvae was seen swallowing large quantities of air which, entering the gut as lengths of silvery cylinders, broke up in bubbles, one behind the other. The larvae were transferred to water in a thick watch glass and supplied with a portion of decayed leaf. They remained more or less submerged, sometimes completely so. From one of these larvae a single adult was produced on February 12, 1932. The larvae never appeared well fed and one of the two was observed as late as February 5, making the larval life a long one.

Mr. Ehrhorn exhibited a number of pupae of the ladybeetle *Chilocorus circumdatus* (Schön.), aligned on a twig.

Dr. Carter exhibited some photographs that showed experimentally-produced pineapple wilt, also "green spotting" by what seemed to be a certain strain or condition of the pineapple mealybug. The anatomy and secretions of these mealybugs were discussed.

NOTES AND EXHIBITION OF FOREIGN MATERIAL

Mr. E. P. Mumford exhibited specimens of three acridids (short-horned grasshoppers) endemic to the Marquesas Islands, together with the following notes. "Endemic Acridids and other Orthoptera of the Marquesas Islands": At the last meeting of the Hawaiian Entomological Society, I exhibited specimens of *Cyphogastra bedoci* Théry, a buprestid endemic to the Marquesas Islands and remarkable for its interesting discontinuous geographical distribution.

I now wish to show specimens of three endemic acridids from the same group of islands. The first of these, a new species of Patanga, was taken for the first time by the Pacific Entomological Survey in large series on the uninhabited island of Eiao, some 54 miles to the northwest of Nukuhiva. This island was visited by the Entomological Survey in September, 1929, and again in April, 1931. It had not hitherto been visited by entomologists.

I also wish to exhibit specimens of *Valanga marquesana* Uvarov which is endemic to the island of Nukuhiva, already mentioned as some 54 miles to the southeast of the island to which the new species of Patanga is restricted.

In addition to the endemic acridids mentioned above, I am showing specimens of the endemic genus and species *Ootua antennata* Uvarov, which is peculiar to the island of Hivaoa, some 90 miles to the southwest of Nukuhiva.

Though there are no native Acrididae in Hawaii, endemic species occur in Samoa.

Two interesting features of the Marquesan acridids (as far as they are at present known) are the restriction of each species to a single island and the presence of as many as three genera. The presence of the endemic genus Ootua is noteworthy.

In addition to the above, the Survey has made collections of an endemic tetrigid of the genus Hydrotetrix. The Marquesan species appear to be morphologically distinct from the Tahitian;

they have similar aquatic habits, frequenting wet rocks on the banks of mountain streams and swimming strongly under water. No species of the family has been described from the Marquesas hitherto. The presence of this genus both in the Marquesas and Society Islands and its absence from the Hawaiian Islands is significant.

Of the two species of Gryllidae, one is widespread in Oceania, and the other is probably distributed by commerce. The Tettigoniidae, represented in Hawaii by endemic species of Banza, are in the Marquesas represented by some remarkable endemic conocephalids. Unlike Hawaii, there are in the Marquesas a number of endemic blattids.

The Phasmidae are represented by a species of stick-insect, *Graeffea crouanii* (Le Guillou), which feeds on the leaves of the coconut.

There are thus only two families of Orthoptera apparently totally unrepresented in the Marquesas, i.e., the Mantidae and Grylloblattidae.

BOOK REVIEWS

Mr. E. H. Bryan, Jr. gave a brief commendatory review of two books, i.e., "Classification of Insects," by C. T. Brues and A. L. Melander, and "Hunting Insects in the South Seas," by Evelyn Cheesman.

JUNE 2, 1932

The 317th regular meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., on June 2, 1932, at 2:30 p.m.

The following members were present: Adamson, Bianchi, Bryan, Ehrhorn, Hagan, Illingworth, Ito, Keck, Mason, Mitchell, Mumford, Phillips, Rosa, Schmidt, Swezey and Van Zwaluwenburg.

Visitor: Mr. Solander.

In the absence of the President, Vice-President Hagan called the meeting to order, and requested Mr. Van Zwaluwenburg to act as Secretary in the absence of Dr. Williams.

Mr. Bryan's comments on Miss Cheesman's book, "Hunting

Insects in the South Seas," led to a discussion by Messrs. Swezey, Adamson and Bryan of native names for insects. Native insect names both here and in other Pacific islands are comparatively few and are seldom specific. In contrast to this there are a great many native names for plants, birds, fish and other more or less conspicuous objects of natural history.

NOTES AND EXHIBITION OF LOCAL MATERIAL

Cremastus hymeniae Vier.—Mr. Rosa exhibited specimens of this ichneumonid reared from *Bactra truculenta* Meyr. (a previously unrecorded host) on Maui. Two specimens of this wasp were reared from cocoons found in dying nutgrass stems, at Lahaina, Maui, on April 23, 1932.

Rhizobius ventralis (Erich.).—Mr. Rosa reported finding a larva of this coccinellid feeding on *Spodoptera mauritia* eggs collected in a cane field at Hana, Maui. The larva was quite small when found and thrived on *mauritia* eggs, finally maturing on May 4, 1932. This is a new record of food habit.

Hister bimaculatus Linn.—Mr. Van Zwaluwenburg reported collecting a specimen of this uncommon beetle on the Schofield Golf Club grounds, May 18, 1932. Mr. Swezey had also found another beetle of this species in a lot of old grass brought in by Dr. Williams from the same locality.

**Cephalonomia peregrina* Westw.—Mr. Swezey reported the recovery of this bethylid at his home in Manoa Valley, May 22, 1932, where it had bred on *Catorama mexicana* Chevr. He secured 7 females and a batch of cocoons from Catorama-infested tomato seeds. This parasite had been liberated there in September, 1930, and it evidently became established. The original ones had come from India in May, 1930, having been found in a cardboard infested with a ptinid that came in a mail package. Several generations were reared and liberated in buildings at the H.S.P.A. in 1930. This is the first recovery.

Empoasca solana De Long.—Mr. Swezey stated that he had recently received this identification by Mr. F. W. Poos of Arlington Farm, Va., for the little green jassid occurring on amaranths and several other weeds and plants.

* Identification furnished by Dr. Marshall. See page 238 in this issue.

Anagyrus saccharicola Timb.—Mr. Swezey reported having collected mealybugs from a field at Oahu Sugar Company, and finding 20 per cent parasitized by this Philippine Anagyrus. From a field at Waianae, 10 per cent were parasitized.

Pseudococcus kraunhiae (Kuwana).—Mr. Swezey reported having found Ipomoea pods infested with this mealybug at Mapulehu, Molokai, April 4, 1932. From these mealybugs he had reared two parasites: *Pauridia peregrina* Timb. and *Leptomastidea abnormis* (Gir.). This is the first record of the latter on Molokai.

Coccotrypes dactyliperda (Fab.).—Mr. Swezey reported finding one of these scolytid beetles in seed of the cabbage palm on May 11, at the Vineyard Street Nursery. It was the first time that he had found it in seeds of this palm.

Lagocheirus obsoletus Thoms.—A specimen of this cerambycid beetle was exhibited by Mr. Swezey, which was collected May 11 in a pupal cell in a log of *Araucaria brazilensis* at the Vineyard Street Nursery, Honolulu. A pupa and several larvae were also found, and numerous exit holes from which the beetles had issued. The larvae fed in the inner bark, then when full-grown each gnawed a circle nearly through the outer bark, before burrowing into the wood to make its pupal cell, lying lengthwise and about ½ inch inside the wood. The circle formed a lid from 1 to 1¼ inches in diameter, which apparently in most cases broke away before the adult beetle was ready to issue. This is a much larger opening through the bark than is necessary to allow the adult beetle to issue, for it is usually about ¼ inch wide, and usually the provision that the larva of cerambycid beetles makes for the exit of the adult through the bark is to gnaw a hole almost through the bark, and merely of sufficient diameter to allow the exit of the beetle.

Pycnoderes 4-maculatus Guer.—Dr. Illingworth found this species infesting squash vines at Kaimuki, May 30, 1932. This species was first reported by him January 2, 1930 (Proc. Haw. Ent. Soc., VII, p. 466) feeding upon purslane.

Engytatus geniculatus Reuter.—Dr. Illingworth found these bugs on squash vines at Kaimuki. The leaves of the plants were

drying up from the effects of a disease showing as a mildew-like growth on the under surface. These bugs have frequently been reported as a pest of tomatoes in the Islands, but none of these plants was growing in the vicinity of the infested squash plants. Squash disease resulting in wilt of the leaves affected was exhibited by Dr. Illingworth. The young leaves showed an abundant population of a green jassid. Spots of mildew soon appeared, followed quickly by drying of the leaf at the edges. In a few days the whole leaf is dry and dead. Other insects found on the plants were *Pycnoderes 4-maculatus* Guer. It is a question, however, whether the insects have any relation to the failure of the plants.

Latrodectus mactans (Fab.).—Mr. Ehrhorn showed an unhatched egg-case of the black widow spider. Both he and Dr. Illingworth commented on the highly cannibalistic habits of this spider.

Rhodesiella elegantula Becker.—Mr. Bryan exhibited a vial of flies handed him by Mr. Keck, which had been caught at Moanalua, Oahu, by Mr. K. H. Lau, May 23, 1932, where they were caught in Mediterranean fruit-fly traps containing a rice bait, in great numbers. The species seems to be *Rhodesiella elegantula* Becker, a hitherto rare fly.

**Agrilus extraneus* Fisher.—The capture of this buprestid by Mr. Bianchi on a blossom of *Argemone glauca* L. at Waipahu, Oahu, in May, was reported. Comparison with specimens in the Bishop Museum shows it to be identical with the specimens recorded by Sharp in the Fauna Hawaiiensis (Vol. 3, p. 400). According to Sharp at that time (1908) the insect was a recent immigrant to Oahu.

Scelio pembertoni Timb.—Mr. Swezey reported the first field recovery of this egg-parasite of *Oxya chinensis* (Thun.). Grasshopper eggs exposed by Mr. Lex Brodie at the Manoa arboretum subsequently yielded two specimens of this scelionid, which was introduced by Mr. Pemberton from the Federated Malay States in 1931.

Erebus odora L.—Mr. Swezey reported that Dr. Williams wrote from Hilo, Hawaii, of finding large numbers of larvae of

* Described on page 249 of this issue. [Ed.]

this species clustered on *Cassia nodosa* Ham. Mr. Swezey suggested that one reason the larvae are so seldom seen is that they may feed nocturnally on the foliage of their various leguminous hosts.

Cephennodes hawaiicus Blattny.—Mr. Van Zwaluwenburg reported that Mr. L. L. Buchanan of the U. S. National Museum writes that the minute scydmaenid beetle found in soil on Tantalus, Oahu, has been given the above manuscript name by Dr. Blattny of Czechoslovakia.

Bufo marinus.—The introduction of the giant West Indian toad from Porto Rico by Mr. Pemberton in April, 1932, was placed on record. Four shipments totalling 148 live toads on arrival were received; these were released at the Manoa Substation (68 specimens) and in a taro patch adjoining the Waipio Substation (80 specimens). This toad was introduced into Porto Rico in 1920 and 1921 from Barbados and Jamaica, and is reported to have increased there to enormous numbers. It is a general insect feeder, being particularly addicted to scarabaeid adults.

EXHIBITION OF FOREIGN MATERIAL

Mr. Adamson exhibited a photograph of a minute Marquesan lathridiid beetle superficially resembling Proterhinus, which Dr. E. C. Van Dyke has described as a new genus, Mumfordea. Two species were taken in the Marquesas by the Pacific Entomological Survey.

JULY 5, 1932

The 318th regular meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., on July 5, 1932, at 2:30 p.m.

The following members were present: Messrs. Adamson, Bianchi, Bryan, Chock, Chapman, Ehrhorn, Mumford, Pemberton, Phillips, Rosa, Schmidt, Smith, Van Zwaluwenburg, Watt and Williams.

Visitor: Miss Suehiro.

President Chapman called the meeting to order.

The minutes of the preceding meeting were read and approved.

NOTES AND EXHIBITIONS

Annoying house mites, presumably from birds' nests, was brought up for discussion by Dr. Chapman, Mr. Pemberton and others participating.

Tromatobia rufopectus (Cresson).—Specimens of this ichneumonid were exhibited by Mr. Rosa. He had collected them in a cane field of the H.S.P.A. Substation at Kailua, Oahu, June 14, 1932. They were issuing from an egg sac of the spider *Argiope avara* Thorell. The larvae feed on the spider eggs, later pupating in the sac. These specimens were identified by Dr. F. X. Williams. This is a new immigrant in Hawaii.

Mr. Bryan exhibited specimens of the following species of flies from the Hawaiian Islands, which had recently been determined for him by Dr. J. M. Aldrich of the U. S. National Museum:

Borborus bilineatus Grimshaw, an endemic species (family Borboridae) from Kahoolawe Id., February 19, 1931, one near the house and one swept from salt bush.

Hecamede albicans Meigen, first record of an immigrant European species (family Ephydridae), swept from salt bush, Kahoolawe, February 14, 1931.

Gymnopa sp., 3 specimens from Kahoolawe, swept from salt bush, February 14, 1931.

Psychoda albipuncta Williston, which Edwards (The Entomologist, 61, p. 32, 1928) places in the genus Telmatoscopus. This large, gray, hairy psychodid is now becoming fairly abundant about water holes, and occasionally coming into houses, where it frequents sinks, washbowls, and windows.

Euplectrus platyhypenae Ashm.—Mr. Bryan exhibited a series of this parasite which were bred from a caterpillar on yellow Coreopsis in his garden in Manoa. The caterpillar was covered with the characteristic hairy fuzz, in which the parasites pupate. Fifty-seven wasps emerged.

**Strumigenys* sp.—Dr. Williams spoke of an ant taken by himself near Olaa, Hawaii, in April and recently identified by Dr.

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* *Strumigenys (Cephaloxys) membranifera* var. *williamsi*. See page 276 of this issue. [Ed.]

W. M. Wheeler of Harvard University as *Strumigenys* of the subgenus *Cephaloxys,* with the remark: "Possibly it is an old, indigenous, relict form."

Anagyrus saccharicola Timb.—Dr. Williams reported the recovery of the Philippine Anagyrus wasp, parasitic on the pink sugar cane mealybug, in Field 33, Honomu Sugar Company, Hawaii, on June 9, 1932.

Scelio pembertoni Timb.—Mr. Pemberton spoke of the recovery, for the second time, of the Scelio wasp, parasitic on Oxya grasshopper eggs, at Waimanalo, early in June of this year. Oxya eggs were placed in the field and brought into the laboratory, where, in due time, Scelio wasps were disclosed. Scelio wasps had been liberated at Waimanalo a considerable time previous. He also exhibited some Porto Rican sugar cane pests and their parasite and spoke of the rapid spread of the cottony-cushion scale on that island and the introduction from Florida of *Vedalia cardinalis,* its ladybeetle enemy.

AUGUST 4, 1932

The 319th regular meeting of the Hawaiian Entomological Society was held August 4, 1932, at the H.S.P.A. Experiment Station, Honolulu, T. H., at 2:30 p.m.

Members present: Messrs. Adamson, Bianchi, Bryan, Chock, Ehrhorn, Illingworth, Keck, Mason, Pemberton, Schmidt, Smith, Swezey, Van Zwaluwenburg and Williams.

Visitors present: Mrs. E. M. Blackman, Mrs. M. E. Washburn, and Mr. Solander.

The President and Vice-President being absent, the Secretary-Treasurer suggested that someone be appointed chairman for the meeting. It was moved and seconded that Mr. E. M. Ehrhorn be so appointed. Mr. Ehrhorn accepted the chair and called the meeting to order.

The minutes of the preceding meeting were read and approved as corrected.

Publication Committee.—Mr. O. H. Swezey reported that the Hawaiian Sugar Planters' Association had assured its financial aid

towards publishing the Proceedings of the Hawaiian Entomological Society, VIII, No. 1, and the work is now well under way.

Mr. C. E. Pemberton reviewed a paper entitled: "Entomological Researches in the Marquesas Islands," by E. P. Mumford and A. M. Adamson, that was presented at the Entomological Meeting in Paris this summer. It brought forth much favorable comment and the hope that the survey be continued to completion.

Mr. E. H. Bryan, Jr., stated that Dr. L. Berland, of the Natural History Museum at Paris, who was undertaking a comprehensive publication on Zoogeography, wrote asking for papers on the Hawaiian insect fauna. After some discussion the chairman suggested that the secretary write to Dr. Berland referring him to the principal entomological works dealing with the Hawaiian insect fauna.

The chairman, Mr. E. M. Ehrhorn, stated that he had received a letter of greeting from Dr. L. O. Howard in Paris.

Mr. A. M. Adamson spoke of the use of cellophane envelopes for Odonata, an innovation of Dr. Needham's.

PAPER

Mr. O. H. Swezey presented a paper entitled, **"New Insect Records on Molokai and Miscellaneous Notes."**

LOCAL NOTES AND EXHIBITS

Adenoneura paraptery.x Meyrick.—Mr. Swezey brought to attention that the tortricid described under this name by Meyrick in Exotic Microlepidoptera, IV, Pt. 7, p. 222, 1932, is the same as we have been calling *A. falsifalcellum* Walsm. This latter name has been used for it in the Proceedings of the Hawaiian Entomological Society, Vol. II, pp. 93, 142; Vol. VII, p. 281.

Hermetia illucens (Linn.).—Dr. Williams exhibited specimens of a large stratiomyid fly, identified as the widespread tropical and sub-tropical American *Hermetia illucens* (Linné) and found also in Samoa. It was noted as an adult insect in 1930, in upper cane fields of Hilo Sugar Company, but not recognized then as something new. During July, 1932, however, a number of individuals were bred from filter-press mud obtained in a mauka field of Hilo Sugar Company, Hawaii. The insect is common in the West Indies where it has also been found to breed in filter-press mud by Van Zwaluwenburg and Wolcott. It is a new immigrant in Hawaii.

Phygadeuon sp.—Specimens of this ichenumonid wasp, apparently a species of *Phygadeuon*, found in the same locality and at the same time as *Hermetia illucens*, were caught chiefly on the filter-press mud wherein also the syrphid flies *Volucella obesa* (Fabr.) and *Lathryopthalmus arvorum* (Fabr.) were breeding. The wasp is parasitic in the puparium of Lathryopthalmus; a rather weak cocoon of silk enclosing the pupa of the hymenopter being found in one puparium. Some of the European Phygadeuonides are parasites of Syrphidae. It is a new immigrant in Hawaii.

Mr. Q. Chock exhibited a handsome araneid spider which he had taken on its web at Pearl City.

Pseudococcus longispinus (Targ.).—Mr. C. Schmidt stated that he found this mealybug on pineapple crowns on the Island of Lanai, most of the adult mealybugs being parasitized by the Chalcid wasp *Anagyrus nigricornis* Timb. This is a new record for Lanai. He further stated that *Hellula undalis* (Fabr.), the imported cabbage webworm, did a great deal of damage to the daikon seedlings in open greenhouses at the Pineapple Experiment Station in Honolulu.

SEPTEMBER 1, 1933

The 320th regular monthly meeting of the Hawaiian Entomological Society was held at the Experiment Station of the Hawaiian Sugar Planters' Association on September 1, 1932, at 2:40 p.m.

Members present: Messrs. Adamson, Bianchi, Bryan, Ehrhorn, Pemberton, Rosa, Schmidt, Smith, Swezey, Van Zwaluwenburg and Williams.

Visitor: Mr. E. L. Caum.

In the absence of both President and Vice-President, Mr. O. H. Swezey was selected chairman for the meeting. Mr. Swezey took the chair.

The minutes of the preceding meeting were read and approved.

The Secretary then read a communication delivered to him some time ago; a letter from Dr. F. G. Krauss, Director of Extension work in agriculture, University of Hawaii, to Dr. R. N. Chapman, President of the Hawaiian Entomological Society. The letter had reference to guarding against the potato tuber moth (*Phthorimaea operculella*) in Hawaii. Following a discussion on

this pest, already well established in Hawaii, a motion was made by Mr. E. H. Bryan, Jr., seconded by Mr. E. M. Ehrhorn, and passed by vote, that the Secretary be instructed to communicate with Dr. Krauss, informing him that the potato tuber moth is already established in Hawaii, and that while the Hawaiian Entomological Society would be glad to advise on control measures, it feels that this problem more fittingly belongs to the entomological department of the Territorial Board of Agriculture and Forestry, or to that of the University itself.

PAPER

"Insects from Kaula Island"

BY E. H. BRYAN, JR.

Specimens were exhibited and Mr. E. L. Caum gave interesting observations on his trip to Kaula Island, showing a number of photographs of this rugged and desolate islet, a sea-bird rookery. Skink lizards were also present. The vegetation was low and scant.

NOTES AND EXHIBITIONS

Mr. F. Bianchi exhibited a spider that he had found in the basement of the H.S.P.A. Experiment Station.

Tinea pellionella L.—Mr. Swezey reported this moth as a host for *Protapanteles hawaiiensis* Ashm. From 14 larval cases found among fibrous litter beneath insect cabinets, 4 of the braconids had already issued, as evidenced by their empty white cocoons inside the cases of the host. This equalled 28% parasitism.

Plagithmysus perkinsi Shp.—Mr. Swezey exhibited a specimen of this longicorn beetle, which had recently matured from a larva found boring in Myoporum at Nauhi, Hawaii, 6,000 feet elevation, September 29, 1931.

Plagithmysus concolor Shp.—A specimen of this longicorn beetle was exhibited by Mr. Swezey, who had reared it from a larva collected under bark of a fallen lehua tree at Halemanu, Kauai, July 6, 1932. The beetle matured August 23. This is the first record of the rearing of this beetle, but it has been collected previously on lehua by Osborn in 1919, and on Ohia ha by Perkins.

Trigoniulus lumbricinus (Gerst.).—Dr. Williams stated that he and Mr. Van Zwaluwenburg, while examining old cane stubble in Field 60, just above Aiea, Honolulu Plantation Company, August 4, 1932, discovered several specimens of this large millipede. This seems to be a new locality record, and its farthest distribution from Honolulu.

OCTOBER 6, 1932

The 321st regular monthly meeting of the Hawaiian Entomological Society was held at the Experiment Station of the Hawaiian Sugar Planters' Association on October 6, 1932, at 2:30 p.m.

Members present: Messrs. Bryan, Chapman, Chock, Ehrhorn, Illingworth, Ito, Keck, Mason, McBride, Mitchell, Pemberton, Phillips, Rosa, Smith, Swezey, Van Zwaluwenburg, Weinrich and Williams.

Visitors: Mr. G. Solander and Dr. W. D. Funkhauser.

President Chapman called the meeting to order. The minutes of the preceding meeting were read and approved.

PHOTOGRAPH COMMITTEE

Mr. Bryan presented the Society with a photograph of the late Dr. N. A. Cobb, an early member of the Society.

PAPERS—LOCAL SUBJECTS

On behalf of Mr. F. Bianchi, Mr. Swezey presented a paper by W. S. Fisher, of the Bureau of Entomology, entitled: **"A New Species of Agrilus from the Hawaiian Islands."**

Coconut weevils from Samoa.—Mr. Swezey exhibited specimens of two weevils recently taken by Mr. Whitney in quarantine inspection, on coconuts received from Samoa, August 11. One was determined as *Aphanocorynes humeralis* Marshall, by comparing with specimens from Samoa, at the Bishop Museum. The other was found to be the same as a *Pentarthrum-like weevil that has been known in Oahu since 1908, but unidentified. This weevil was first collected on sugar cane (beneath leaf sheaths) at Waialua in 1908; at Ewa Plantation in 1912 and 1932; at Waipio, on bark of algaroba tree, in 1919. Apparently it is of no importance as it remains rare.

* Later identified by Dr. Marshall from Oahu specimens as *Stenotrupis filum* Fairm. from Tahiti. [Ed.]

Aspidiotus lataniae Sign.—Mr. Swezey reported that Mr. Whitney had identified as this species a scale insect infesting gladiolus corms handed in by Dr. Forrest Brown. Apparently it is the first record of it infesting gladiolus in Hawaii. It usually infests palms.

Contarinia maculipennis Felt.—Mr. Swezey reported that Dr. Williams had found the hibiscus bud-midge affecting the flowers of his Tantalus white hibiscus growing at Woodlawn, Manoa Valley, Sept. 5. The petals were somewhat crumpled by the injury of the midge larvae while still in bud. The injured buds did not fall off as has heretofore been noticed with other hibiscus buds when attacked by the midge larvae. The flower opened normally except that those petals which happened to have been injured were somewhat crumpled.

Rhynchephestia rhabdotis Hamps.—Mr. Swezey exhibited this phycitid moth and called to attention that its description had been published in Ann. Mag. Nat. His. (10), V, p. 52, 1930. This is the moth whose larvae feed in the flower heads and in the stems of the silversword (*Argyroxiphium sandwicense* var. *macrocephalum*) in Haleakala Crater, Maui.

Tromatobia rufopectus (Cress.).—Mr. Swezey reported having reared nine females and two males of this ichneumonid from an egg cocoon of *Argiope avara* Thor. collected in Makua Valley, Sept. 27, 1932. From the eggs of the mass that were not eaten, 360 spiders hatched Oct. 8. The 11 parasites issued from their cocoons Oct. 10. Mr. Swezey reported also having caught a specimen of this parasite at Gunsight Pass in the Waianae Mts., Sept. 11, 1932. It was in the vicinity of a web of a large spider different from *Argiope avara*, probably a species of Epeira. No egg cocoons were found.

Toxomerus marginatus (Say).—Mr. Swezey exhibited this small syrphid fly which he had caught at Kokee, Kauai, June 14, 1932. It is the first record of it in the Hawaiian Islands. It is a common species in the United States, where it has been recorded as a predator on aphids. It was quite common at Kokee, but its habits were not observed, except that the adults were about flowers of California daisy and English plantain.

Antonina indica Green *on Sugar Cane.*—The finding of this coccid (identified by Mr. Swezey) on Lahaina cane, among the aërial roots just above ground, was reported by Mr. Van Zwaluwenburg. Two plants among 30 grown outdoors on isolated tables at the Alexander Street plot (Honolulu) for about six months, harbored the insect, mature females of which were present. Manienie (Bermuda) grass and a few species of Paspalum are commonly hosts of *A. indica*, but the previous finding of the species on sugar cane does not appear to have been published. Dr. Williams has recently found an Antonina on aerial roots of sugar cane in the germinating house at Mapulehu, Molokai, on September 25, 1931.

Reduviolus capsiformis (Germ.).—Mr. Bryan exhibited a specimen of this bug (Nabidae) which had been caught by Mrs. Bryan on the lawn of their home in Manoa. Another specimen of what is thought to have been the same species was found sucking blood from the baby, having raised three small welts on his neck.

Pyralis mauritialis Boisd.—Mr. Bryan exhibited for Miss Suehiro: 35 or more of this moth which had issued from a nest of *Polistes hebraeus* (Fabr.) at Bishop Museum during August and September. Wasp's nest was collected by K. O. Moe.

Chloridea obsoleta (Fabr.).—Dr. Williams reported taking a young caterpillar of the corn ear worm in a head of sudan grass at Mapulehu, Molokai, on September 26, 1932.

Scymnus pictus Gorh.—Mr. Chock reported the recovery at Kunia, Oahu, on August 23 of this year, of the neotropical cecidomyid fly* and the coccinellid (*Scymnus pictus*) which are enemies of the pineapple mealybug, introduced from Mexico in 1930.

NOTES—FOREIGN SUBJECTS

Mr. Swezey presented the following recent determinations of Indian insects, by Dr. Marshall:

Zeugenia glutae Mshl. n. sp.—A weevil taken in quarantine inspection in Honolulu in seeds of *Gluta travancorica* from India, December 3, 1929. Dr. Marshall found it to be a new species, the description of which will be published shortly.**

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* *Lobodiplosis pseudococci* Felt. Journ., New York Ent. Soc., XLI, p. 87, 1933. [Ed.]
** Marshall. Stylops, I, pt. 10, p. 212, 1932. [Ed.]

Gastrallus laticollis Pic.—An anobiid found in cardboard used in packing in a package from India, May, 1930.

Cephalonomia peregrina Westw.—A bethylid found parasitizing larvae of the preceding beetle. Several generations of this parasite were bred in Honolulu on various species of Anobiidae, and some liberations made. After about a year a recovery was made, indicating that it has become established. (Det. by Dr. Ferrière.)

NOVEMBER 3, 1932

The 322nd regular meeting of the Hawaiian Entomological Society was held at the Experiment Station of the Hawaiian Sugar Planters' Association on November 3, 1932, at 2:30 p.m.

Eighteen members were present.

President Chapman called the meeting to order.

The minutes of the preceding meeting were read and approved as corrected.

The President read the obituary notice of Dr. B. W. Evermann, Director of the Museum of the California Academy of Sciences and of the Steinhart Aquarium. Dr. Evermann, an ardent naturalist, was acquainted with many of us in Hawaii.

Mr. G. Solander was elected to junior membership.

The Secretary read some correspondence re the potato tuber moth in Hawaii.

LOCAL PAPERS

Mr. C. E. Pemberton read a paper entitled "**Delayed Incubation Among Eggs of Oxya chinensis** (Thun.)."

LOCAL EXHIBITS OF MATERIAL

Mr. E. M. Ehrhorn recorded the following species at 3,500-ft. elevation on Maui:

Scolia manilae Ashm.

Polistes fuscatus var. *aurifer* Sauss. with stylops (*Xenos auriferae* Pierce).

Pseudococcus adonidum on Myoporum sp. attended by ants.

Pheidole megacephala and *Tetramorium* sp. (?)

Carpophilus humeralis—pineapple beetle.
Haplothrips usitatus, blossoms.

Stenommatus musae Marshall.—This small weevil was exhibited by Mr. Swezey, who had collected several specimens in rotting banana corms in his garden in Manoa, September 24, 1932. This is the first record of his finding this weevil since the original discovery in banana corms in Kaimuki, February 19, 1920. Dr. Marshall described it at that time as a new species. Later he recorded it from bananas from S. Africa, imported from Java, which he considered its home.

New Elaterid records from the Tuamotus.—Mr. R. H. Van Zwaluwenburg exhibited specimens of *Simodactylus cinnamomeus* (Boisd.) and *Conoderus pallipes* (Esch.), collected on the island of Makatea, Tuamotu Archipelago, in September by Dr. Gerrit P. Wilder. Although the two species are widely spread in the Pacific, Makatea is a new locality record for each. For *C. pallipes* this westernmost island of the Tuamotus thus far marks the eastern limit of its known range.

Oligotoma texana (Mel.).—Mr. Bryan called attention to an article by Harlow B. Mills in the Annals of the Entomological Society of America, Vol. XXV, No. 3, September, 1932, pages 648-652, on the life history and thoracic development of *Oligotoma texana* (Mel.) (Embiidina), in which the author suggests that the external appearance of the wing pads of male embiids takes place during more than one instar, thus substantiating the somewhat discredited observations of Dr. R. C. L. Perkins, made in Entomologist's Monthly Magazine, 1897, pp. 56-58, for *Oligotoma insularis* McLach.

Chalybion caeruleum (Linn.).—Dr. Williams reported seeing at close quarters a female of the steel-blue, mud-daubing wasp (*Chalybion caeruleum* (Linn.), a recent immigrant, a single specimen of which was taken in Honolulu on June 8, 1931, and specimens of what seemed to be the same species observed flying about a fence at Ewa Plantation Company, in March, 1932.

Mr. Bryan stated that several papers of the Pacific Entomological Survey had just been published by the Bishop Museum.

DECEMBER 1, 1932

The 323rd regular meeting of the Hawaiian Entomological Society was held at the Experiment Station of the Hawaiian Sugar Planters' Association, on December 1, 1932, at 2:30 p.m.

Members present: Messrs. Bryan, Chapman, Hadden, Hong, Illingworth, Ito, Keck, Marlowe, Mason, McBride, Mitchell, Pemberton, Riley, Rosa, Schmidt, Smith, Solander, Swezey, Van Zwaluwenburg, Whitney, and Williams.

Visitors: Miss Suehiro and W. Y. Whang

President Chapman called the meeting to order. The Secretary then read the minutes of the preceding meeting. Approved as read. Announcement was made of the resignations from the Society of Mr. J. T. Watt and Dr. H. Hagan. It was moved by Mr. Pemberton and seconded by Mr. Hadden that these two resignations be accepted with regrets by the Society, through the Secretary-Treasurer.

Election of officers for 1933 resulted as follows:

President: C. E. Pemberton
Vice-President: O. C. McBride
Secretary-Treasurer: F. X. Williams

Additional members of Executive Committee:

E. M. Ehrhorn and O. H. Swezey.

The Treasurer presented the financial report of the Society for the period beginning December 3, 1931, and ending December 1, 1932. It was accepted subject to auditing, and the President appointed Mr. O. H. Swezey a committee of one to audit this account.

Presidential address: **"The Causes of Fluctuations in Populations of Insects,"** by Dr. R. N. Chapman. This interesting paper brought forth much discussion.

PAPERS ON LOCAL SUBJECTS

"New Hawaiian Lepidoptera," by O. H. Swezey.

"Notes on Tromatobia rufopectus in Hawaii," by O. H. Swezey.

"Introduction to Hawaii of Malayan Parasites (Scelionidae) of the Chinese grasshopper Oxya chinensis (Thun.), **with Life History Notes,"** by C. E. Pemberton.

"New Hawaiian Coleoptera, with Notes on Some Previously Known Species," by Dr. R. C. L. Perkins (presented by title by O. H. Swezey).

EXHIBITION AND DISCUSSION OF LOCAL MATERIAL

Isodontia harrisi Fernald.—Mr. Swezey reported having observed a female of this wasp with a nymph of *Conocephalus saltator* (Sauss.) which she was apparently carrying to her nest or burrow. The occurrence was by the roadside along a cane field near the mouth of the valley leading from Sacred Falls, November 11, 1932.

Sphetcrista tetraplasandra (Sw.).—Mr. Swezey exhibited a series of 6 females of this tortricid moth reared from caterpillars collected by him on leaves of Tetraplasandra on the ridge leading up to Puu Kaua, Waianae Mts., Oahu, November 6, 1932. The species was described as a Capua by Swezey (Proc. Haw. Ent. Soc., IV, p. 385, 1920) from 2 male specimens bred from fruits of Tetraplasandra at Wailupe and Kaumuahona, Oahu, respectively. Examination of the types and the more recent specimens shows that the species goes to the genus Spheterista erected by Meyrick to contain *Capua variabilis* Walsm. and *C. pleonectes* Walsm., and possibly some other Hawaiian species. Meyrick described *S. asaphopis* in Proc. Haw. Ent. Soc. VII, p. 96, 1928. *S. pleonectes* and *S. asaphopis* were both reared from caterpillars on leaves of Cheirodendron.

Ceratitis capitata Wied.—Mr. Swezey reported finding fruitfly maggots in breadfruit, November 21, 1932, from which the flies issued later. This appears to be the first record of the Mediterranean fruitfly breeding in breadfruit.

Acythopeus gilvonotatus Barber.—Mr. Swezey reported that he had recently identified as this species of weevil a specimen collected by Dr. Lyon in orchid greenhouse, Honolulu, April 24, 1916. Barber's description is in Proc. Ent. Soc. Wash., XIX, p. 17, pl. 4, figs. 3, 3A, 1917.

Leucostoma aterrima Villers.—Mr. Swezey exhibited specimens of this tachinid fly which had recently been determined by Dr. Aldrich, and now recorded for the first time under this name in

the Hawaiian Islands. The specimens had been taken for *atra* Towns., which had been identified in 1921 by Dr. Aldrich. (Recorded in Proc. Haw. Ent. Soc., V, p. 30, 1922.) In a recent letter Dr. Aldrich points out the following differences: "The males are easily separated because in *aterrima* the last two segments of the abdomen are pollinose, while in *atra* they are highly shining like the remainder of the fly. The females of *aterrima* have an elongated, slender abdomen, while in *atra* it is of the ordinary form; in both it is entirely black. Another difference, more tangible, is that in *atra* the female has a pair of erect bristles on each side of the first three segments near the hind margin, while in *aterrima* the last segment has only depressed bristles, not an erect pair."

Dr. Aldrich states that the *Leucostoma analis* Meigen? recorded in the Fauna Hawaiiensis, III, p. 20, 1901, is a synonym of *aterrima*.

The specimens recently examined and determined by Dr. Aldrich are as follows:

Leucostoma aterrima—1, Koloa, Kauai, 1908 (Swezey); 1, Ewa Coral Plain, Oahu, 1920 (Williams); 1, Puuloa, Oahu, ex *Corizus hyalinus,* 1920 (Swezey); 1, Kaimuki, Oahu, 1921 (Swezey); 2, Waianae, Oahu, 1930 (Swezey).

Leucostoma atra—1, Honolulu, Oahu, 1920 (Williams).

Pycnoderes 4-maculatus Guerin.—Specimens of the mirid bug *Pycnoderes 4-maculatus* Guerin were exhibited by C. E. Pemberton. He found adults fairly common on garden beans at the residence of A. M. McKeever, Lihue, Kauai. This is the first record of its occurrence on that island. It was first seen in Hawaii on December 11, 1929, by Dr. J. F. Illingworth, who collected it on purslane in Honolulu.

Hypoderma lineata De Villiers.—Mr. Pemberton reported observing with Mr. Swezey the larvae of the ox bot fly (determined by Swezey) in the hides of freshly slaughtered steers from the Kukaiau Ranch, Hawaii. Some of the hides examined had a half dozen or more small holes along the back made by the larvae. Since these cattle were born and reared at Kukaiau, they had become infested at this locality, which indicates that the fly is established in Hawaii. Former recoveries of these larvae in the Terri-

tory have been made only in cattle brought from the mainland and presumably infested there.

Scelio pembertoni Timb.—Mr. Pemberton reported the recovery of *Scelio pembertoni* Timb. from Waimanalo Plantation on June 2, 1932, and again from the same locality during November, 1932. It was also recovered from Waianae Plantation during November, 1932, and a second time during November, 1932, from Upper Manoa Valley. These recoveries were all made by exposing unparasitized *Oxya chinensis* eggs in each locality for from 3 to 7 days and then bringing them to the laboratory and holding in vials for parasite emergence. At each point where parasites were recovered, liberations had been made from 3 months to a year previously with material bred in the laboratory from parasites introduced from the Federated Malay States during 1930-31.

Vespa occidentalis Cresson.—Mr. Pemberton reported having collected a specimen of *Vespa occidentalis* Cresson from a cane leaf at Lihue Plantation, Kauai, November 22, 1932. This is a new locality for it on Kauai. It has not been found on the other islands of the group and has been previously known only in the mountainous portion of western Kauai since January, 1919 (A. Kusche), and at Kilauea Plantation on the north side of the island since September 29, 1930 (F. X. Williams).

Mapsidius auspicata Walsm.—A series of specimens of this moth was exhibited by Mr. McBride that had reared from larvae and pupae brought in from the Hawaii National Park, Kilauea, Hawaii, where they were feeding very abundantly on the foliage of Charpentiera trees. This moth was originally collected by Perkins on Kauai and Lanai. It has been reared by Swezey on Oahu where it is common on Charpentiera. It has not been recorded previously from the island of Hawaii.

Brachistella lutea (Fullaway).—The rearing of this trichogrammid from the eggs of the jassid *Draeculacephala mollipes* (Say), collected in sugar cane leaf at Olowalu, Maui, in November, making a new island record for this parasite, was reported by R. H. Van Zwaluwenburg. The identification was made by Mr. Swezey.

Pheidole megacephala (Fabr.).—Dr. Illingworth stated that there appears to be a lack of evidence of mating flights of this

species of ants. Just after daylight of the morning of November 15, following a heavy rain in the night, the air at Kaimuki was filled with flying insects, extending to great heights. Some of these were captured and they proved to be queens of this species. No males were in evidence. Apparently the flight was nearly over when discovered, the insects settling rapidly to the ground. After about a quarter of an hour none was in evidence. They had scattered widely, and upon alighting quickly sought shelter, crawling beneath rubbish or into cracks in the soil, etc. During the past 20 years several flights of the males of this ant have been observed by Dr. Illingworth. These occurred in the late evening, the insects coming to lights. The indications are that these flights take place during darkness, which would explain the scarcity of observations on this subject.

Taeniothrips gladioli M. & S.—Dr. Chapman mentioned the recent discovery of the presence of this gladiolus pest in Honolulu. Mr. Chock, who was not present, had found gladiolus very severely injured by this thrips at florist gardens in Nuuanu Valley, November 17. It was afterward found in other localities in Honolulu, and Mr. Chock had found it established already on the islands of Maui and Hawaii. Specimens had been submitted by Mr. Whitney to Mr. Steinweden in San Francisco for verification of its identity.

Insects from Kaula Island

BY E. H. BRYAN, JR.

(Presented at the meeting of Sept. 1, 1932)

Mr. Edward L. Caum collected a few specimens of insects on Kaula Island, which lies about 20 miles southwest of Niihau, August 18, 1932. The island is the remains of an ash or tuff cone, about a mile from one extremity of the crescent-shaped ridge to the other, and rising precipitously to a height of about 600 feet, from an extensive submarine platform. (See Palmer, B. P. Bishop Museum Bulletin 35, 1927.)

No insects have been previously reported from Kaula, the Tanager Expedition having been unable to land in 1923. The present list contains fifteen species, most of which are immigrants, widespread throughout the Hawaiian group.

HYMENOPTERA

Holepyris hawaiiensis (Ashmead), 1 specimen (Det. by O. H. Swezey).

Eupelmus sp., 1 male and therefore not to be determined (O. H. Swezey).

Prenolepis longicornis Latr., 4 specimens on flowering Euphorbia.

Monomorium floricola Jerdan, numerous specimens on all the plants, especially the Euphorbia and Sida, which were in flower.

DIPTERA

Scenopinus fenestralis (Linn.), 2 specimens, found inside Sida blossoms.

Sarcophaga barbata Thomson, 1 specimen, the only one seen.

Lucilia sericata (Meigen), 11 specimens, "common everywhere, especially swarming on the flowers of Euphorbia."

Siphunculina signata (Woll.), 1 specimen, found in Sida blossom.

COLEOPTERA

Coelophora inaequalis (Fabr.), 1 specimen, the only one seen.

Scymnus kinbergi Boh., 1 specimen on Euphorbia.

LEPIDOPTERA

Petrochroa sp. 1 specimen, too much abraded for determination, but possibly identical with an undescribed species from Oahu, or with *P. neckerensis*. (O. H. Swezey.)

HOMOPTERA

Delphacid, 1 small nymph, probably on Sida blossoms.

THYSANOPTERA

Haplothrips usitatus (Bagn.), 4 specimens (Det. by O. H. Swezey.)

EMBIIDINA

Oligotoma insularis McLachlan, 2 specimens in the thin mat of roots and soil under plants.

CHELONETHIDA

Pseudoscorpions, 4 specimens in soil under plants.

A Hibiscus Bud Midge New to Hawaii

BY E. P. FELT

Bartlett Tree Research Laboratories, Stamford, Connecticut

An excellent series of midges was received from Mr. O. H. Swezey, Entomologist, Experiment Station of the Hawaiian Sugar Planters' Association, Honolulu, under date of January 8, 1932, and accompanied by the statement that they had been recently reared from buds of hibiscus in Honolulu. The species is reported to be new in that section of the world, and had been found in only two places in Honolulu at the date of writing. The larvae of this species cause the buds to fall off before the flowers open.

Contarinia maculipennis n. sp.

Male. Length .75 mm. Antennae nearly twice the length of the body, thickly haired, yellowish brown; 14 segments, the fifth with stems each with a length two and a half times their diameters; terminal segment having the basal portion of the stem with a length four times its diameter, the distal enlargement pyriform and with an apical, finger-like process having a length approximately three times its diameter. Palpi: the first segment subquadrate, the second with a length over twice its width, the third with a length three times its width and the fourth one-half longer than the third. Mesonotum, reddish brown, the submedian lines fuscous yellowish. Scutellum, yellowish brown; postscutellum fuscous yellowish. Abdomen a variable dark yellowish brown. Wings subhyaline, variably fuscous, especially along the veins. Halteres mostly pale yellowish, brownish subapically. Legs: coxae and femora pale yellowish; tibiae yellowish, fuscous apically; tarsi mostly dark brown, an indistinct subapical band on the second segment and most of the third, fourth and fifth segments yellowish on the posterior legs. Genitalia: dorsal plate broad, deeply and narrowly emarginate, the lobes angularly rounded.

Female. Length, 1 mm. Antennae about three-fourths the length of the body, sparsely haired, yellowish brown; 14 segments, the fifth with a stem about one-third the length of the cylindrical basal enlargement, the latter with a length about two and a half times its diameter; terminal segment produced, the basal portion with a length four times its diameter and apically with a short broad process, the latter with a length about twice its diameter. Palpi: first segment subquadrate, the second with a length over three times its diameter, the third as long as the second, the fourth one-half longer than the third. Mesonotum, reddish brown, the submedian lines yellowish. Scutellum, yellowish brown, postscutellum, fuscous yellowish. Abdomen a variable fuscous yellowish. Ovipositor, yellowish, one-half

longer than the body, the terminal lobes slender with a length about six times the width. Wings distinctly subhyaline and more highly colored than in the male. Legs: coxae and femora mostly pale yellowish, with tarsi yellowish brown except a broad subapical band on the second segment and the third, fourth and fifth segments which are yellowish on the posterior legs.

Types deposited in the United States National Museum (No. 43940). Cotypes in the collections of the Hawaiian Entomological Society, and of the Experiment Station of the Hawaiian Sugar Planters' Association, Honolulu.

A New Species of Agrilus from the Hawaiian Islands (Coleoptera: Buprestidae)

BY W. S. FISHER

Associate Entomologist, Bureau of Entomology, United States Department of Agriculture

Agrilus extraneus n. sp.

Agrilus sp. Sharp, Fauna Hawaiiensis, vol. 3, part 5, 1908, p. 400.

Male. Moderately elongate, vaguely flattened above, and rather strongly shining; head bright green, becoming cupreous on the occiput; pronotum and elytra olivaceous green, with a distinct aeneous and cupreous tinge in certain lights; beneath aeneous green, with the tarsi blackish.

Head with the front wide, feebly convex, about equal in width at top and bottom, the lateral margins feebly, arcuately expanded at vertex, and with a feeble, longitudinal groove on vertex and occiput; surface densely, finely granulose and irregularly, transversely rugose on the front, becoming longitudinally rugose on the occiput, with a few moderately coarse punctures between the rugae, and sparsely clothed, especially behind the epistoma, with moderately long, semierect, silvery white hairs; epistoma transverse between the antennae, and broadly, feebly, arcuately emarginate in front; antenna extending to middle of pronotum, serrate from the fourth joint, and the outer joints wider than long; eyes large, broadly oval, and equally rounded above and beneath.

Pronotum one-half wider than long, narrower at base than at apex, and widest at apical fourth; sides feebly rounded from apical angles to middle, then obliquely narrowed to the posterior angles, which are rectangular; when viewed from the side the marginal and submarginal carinae are feebly sinuate, widely separated anteriorly, and connected to each other at basal third; anterior margin strongly sinuate, with a broadly rounded median lobe; base deeply emarginate at middle of each elytron, with the median lobe freely, broadly rounded, and subtruncate or feebly emarginate in front of scutellum; disk moderately convex, broadly, vaguely depressed on each side along lateral margin, and with the prehumeral carinae only feebly indicated; surface rather finely, densely, transversely rugose, sparsely, finely punctate between the rugae, and sparsely clothed at the sides with short, recumbent, whitish hairs. Scutellum transversely carinate, and the surface finely, densely reticulate.

Elytra slightly wider than pronotum at base, and about equal in width at base and behind middle; sides parallel for a short distance behind base, broadly, arcuately constricted near middle, broadly, arcuately expanded behind middle, then obliquely narrowed to the tips, which are separately, narrowly rounded, and finely serrulate; sides of abdomen broadly exposed above; disk moderately convex, and with broad, moderately deep, basal depressions; surface finely, densely imbricate-punctate, and rather densely, uniformly clothed with short, recumbent, white hairs.

Abdomen beneath rather sparsely, finely punctate, and sparsely, uniformly clothed with recumbent, white hairs; vertical portions of segments slightly more densely pubescent than ventral surface; first and second

Proc. Haw. Ent. Soc., VIII, No. 2, November, 1933.

segments convex, and clothed with long, erect, white hairs at the middle; pygidium not distinctly carinate at middle. Prosternum finely, densely punctate or rugose, and rather densely clothed with long, white hairs, which are recumbent at the sides, erect at the middle, and extending along the median part of the body to the second abdominal segment; prosternal lobe broad, strongly declivous, and broadly rounded or subtruncate in front; prosternal process rather broad, the sides nearly parallel to behind the coxal cavities, then obliquely narrowed to the apex, which is acutely rounded. Posterior coxae with the posterior margin transversely truncate or feebly sinuate, and the exterior angle rectangular and not prolonged. Tibiae slender, and the anterior and middle pairs armed with a short tooth on the inner margin at apices. Posterior tarsus about one-half as long as tibia, and the first joint as long as the following two joints united. Tarsal claws dissimilar (claws on posterior feet missing); claws on anterior feet cleft near the tip, the teeth acute, and nearly equal in length; claws on middle feet cleft near middle, the inner tooth broad, much shorter than the outer one, and not turned inward. Length, 4.75 mm.; width, 1.4 mm.

Female. Unknown.

Type locality.—Honolulu, Oahu, Hawaiian Islands.

Other locality.—Waipahu, Oahu.

Type.—Bishop Museum.

Paratypes—In the United States National Museum, Washington, and in the collection at the Experiment Station of the Hawaiian Sugar Planters' Association.

Described from three males, the type and one paratype collected at the type locality by R. C. L. Perkins (Perkins No. 757), and one paratype collected at Waipahu, Oahu, May, 1932, feeding on the pollen of *Argemone glauca,* by F. A. Bianchi. The three specimens were sent to me for identification by Mr. Bianchi; two of these specimens are from the Bishop Museum, and are the specimens referred to by Sharp[1] as having been recently introduced into Oahu. Without any doubt this is an introduced species, as no species of Buprestidae have been recorded as indigenous to the Hawaiian Islands.

This is one of the obscure forms of this large genus, and resembles *Agrilus davaoensis* Fisher from the Philippine Islands. It differs, however, from that species in having the pubescence on the elytra more uniformly distributed, the prosternum without distinct depressions or prehumeral carinae, the prosternal process parallel to behind the coxal cavities, and the prosternum and first two abdominal segments clothed at the middle with long, erect, white hairs.

[1] Fauna Hawaiiensis, vol. 3, part 5, 1908, p. 400.

Delayed Incubation Period Among Eggs of Oxya chinensis (Thun.) (Orthoptera)

BY C. E. PEMBERTON

(Presented at the meeting of November 3, 1932)

Hibernation in the egg stage in Acrididae of temperate zones is generally assumed to be caused primarily by low winter temperatures. This tendency is so marked that with some species eggs laid in the autumn and held indoors at warm temperatures undergo the same retarded development prevailing under outdoor conditions. However, with some tropical or semitropical species it has been shown that hibernation in the egg stage may be induced by drought in regions having long dry periods at more or less regular intervals.

In view of the above it is of interest to give some cases of delayed incubation in the eggs of the Chinese grasshopper *Oxya chinensis* (Thun.) where neither low temperatures nor drought were operative during the entire period of incubation.

In the course of breeding the egg parasites *Scelio serdangensis* Timb. and *S. pembertoni* Timb. of this grasshopper in Malaya during 1930 and in Honolulu in 1931, thousands of Oxya eggs were held in glass tubes for many months. In order to secure exact life cycle data on the parasites, the various lots of Oxya egg pods were kept segregated and the emergence of both parasites and hoppers tabulated. The greater proportion of unparasitized eggs produced hoppers in about 6 weeks both in Malaya and Honolulu. Swezey * originally records the incubation period in Hawaii as 6 weeks. This may be taken as the normal duration of the egg stage. The following exceptions to the average of approximately 42 days, obtained in the handling of many thousands of eggs, which were kept constantly over wet cotton in glass containers at normal Honolulu and Malayan temperatures, represent extremes in our data, and though of rare occurrence, have been of sufficient frequency in both localities to be recorded as a definite life habit for this species.

* Hawaiian Planters' Record, vol. XXX, no. 3, p. 381, July, 1926.

AT SERDANG, FEDERATED MALAY STATES

Eggs deposited	Eggs hatched	No. hatching	No. days
Sept. 18, 1930	Jan. 11, 1931	11	114
Sept. 18, 1930	Jan. 16, 1931	6	119
Oct. 1, 1930	Feb. 25, 1931	13	147
Oct. 1, 1930	Feb. 26, 1931	14	148
Oct. 1, 1930	Feb. 27, 1931	3	149
Oct. 1, 1930	Feb. 28, 1931	7	150
Oct. 1, 1930	Mar. 1, 1931	1	151
Nov. 18, 1930	Mar. 31, 1931	1	132
Nov. 23, 1930	Mar. 30, 1931	1	126

AT HONOLULU, HAWAII

Eggs deposited	Eggs hatched	No. hatching	No. days
Aug. 1, 1931	Nov. 18, 1931	2	108
Sept. 2, 1931	Jan. 9, 1932	16	128
Sept. 2, 1931	Jan. 12, 1932	3	131
Sept. 2, 1931	Jan. 17, 1932	1	136
Sept. 21, 1931	June 26, 1932	1	277
Sept. 24, 1931	Jan. 22, 1932	8	119
Sept. 24, 1931	Jan. 24, 1932	5	121
Oct. 9, 1931	Jan. 6, 1932	17	88
Oct. 9, 1931	Jan. 11, 1932	13	93
Oct. 11, 1931	June 9, 1932	10	240

Introduction to Hawaii of Malayan Parasites (Scelionidae) of the Chinese Grasshopper Oxya chinensis (Thun.) with Life History Notes

BY C. E. PEMBERTON

(Presented at the meeting of Dec. 1, 1932)

DISCOVERY AND IMPORTATION

The immigrant grasshopper *Oxya chinensis* (Thun.) has been known in Hawaii for at least 35 years. Its spread and the increased notice of its damage to sugar cane since 1925 led the writer to undertake a study in 1930-31 of natural enemies which might attack it in the Federated Malay States. Seven species of Oxya, including *O. chinensis* have been recorded from Malacca and the Malay Peninsula.[1] Egg parasites of grasshoppers of this genus have been noted in India [2] and the assumption that parasites also occurred in the Malay Peninsula proved correct after six weeks of study.

At Serdang, in the State of Selangor, F. M. S., adult *Oxya chinensis* grasshoppers were confined in field cages resting directly on the ground and covered with large mesh wire screen. Eggs were thus obtained in the soil beneath these cages under field conditions and parasites, if present, could readily pass through the screen to reach the eggs. The egg pods were periodically removed from the soil and held in glass tubes for observation. From the first three lots of egg masses so obtained, two new species of scelionid parasites emerged in sufficient quantity for laboratory breeding operations to start immediately. These parasites *Scelio serdangensis* Timb. and *Scelio pembertoni* Timb. have since been described by P. H. Timberlake.[3]

Between December, 1930 and April, 1931, thirteen shipments of parasitized Oxya egg pods were made to Honolulu, from which about 2600 parasites, representing both species, were reared and many liberated in various parts of the Hawaiian Islands. Further breeding and liberation has continued to date (November, 1932) in Hawaii with a total distribution mostly to sugar plantations of

about 37,000 parasites. This has resulted in the known establishment of *Scelio pembertoni* in several localities where attempts to recover the parasites have been made.

Early in the breeding work in Honolulu, the species *Scelio serdangensis* gradually died out and in a few months only the one species *S. pembertoni* remained. The bulk of the liberations have hence been of the latter.

Figures 1 to 8 inclusive are given to furnish a ready means of distinguishing the two species.

LIFE HISTORY AND HABITS

The following are taken from notes and breeding data on the biology of *Scelio pembertoni*:

Oviposition:

The parasite deposits its eggs directly within those of the grasshopper. The eggs of the latter are laid slightly underground in masses of about 15 to 25, cemented and enclosed together in a white, frothy secretion which quickly hardens to a porous, brown, corky consistency forming what is commonly termed an egg pod (Figures 14 and 15). Such pods are reached by the parasite without apparent difficulty by penetration through the soil space left open over the pod when the grasshopper withdraws the tip of its body after egg deposition. Should soil fall in and completely cover the egg pod, the parasite can evidently force its small body between the loosely packed particles with ease. In laboratory breeding it was found that Scelio females would force their way through ¼ to ½ inch of coarse sand to reach Oxya egg pods so covered. As the body is compact, hard and only from 3.1 to 4.25 mm. long, no fossorial structures are present or required for the shallow penetration of soil necessary to locate Oxya eggs.

Upon reaching the grasshopper egg pod the Scelio female immediately applies the tip of the ovipositor and usually assumes the position indicated in Figure 15. Sometimes she eats a hole into the egg pod. Occasionally this may be as deep as the length of her body. When such a hole is prepared she then backs into it and commences prodding the egg pod in search of eggs in which to oviposit. The ovipositor may be described as a flexible, tubular

process 9 mm. in length and completely telescoped within the abdomen. It is clearly chitinized only for 2 mm. at the distal end. This portion consists of the two piercing blades or stylets and the stylet sheath, the tips of which are shown in Figure 9. Each stylet (Figure 9A) bears a group of about 10 well-formed, compactly placed barbs or lateral expansions about 1 mm. from the tip, as shown in the figure. It is probable that these structures, which extend backwards, facilitate oviposition by holding the ovipositor at least 1 mm. into the Oxya egg once it has been pierced and thus enabling the delicate egg of the parasite to pass well into the host egg before the guiding blades of the ovipositor are removed. The stylet sheath (Figure 9B) is not barbed. It no doubt functions as a piercing blade also since it is even more delicate and sharply pointed than the stylets.

During oviposition the ovipositor is slowly extruded and forced into the porous, corky egg pod in search of an egg. The body of the parasite, with the exception of the ovipositor parts, remains almost entirely motionless. This may last a half hour or longer. In case distant eggs in the pod are sought the ovipositor becomes extended over twice the length of the body. A close correlation exists between the size of Oxya egg pods and the greatest extension possible for the Scelio ovipositor. The longest axis of 82 egg pods deposited in moist sand and of normal shape and size was found to average 9.3 mm. and as above stated the ovipositor is capable of extension to a distance of 9 mm.

The withdrawal of the ovipositor after having been fully extended into a grasshopper egg pod is always accomplished slowly and only after much strenuous exertion. Occasionally a female may fail to ensheathe or telescope the ovipositor tube back into the abdomen after oviposition. In such cases the long, glistening, pale yellow tube remains permanently protruding and in such a state the parasite is incapable of further egg laying; but may otherwise feed and appear perfectly normal in spite of the encumbrance.

Oviposition, once started, may last for several hours without interruption. Females have been observed to oviposit or at least attempt oviposition in the same egg pod for 3 to 5 hours continuously without once withdrawing the ovipositor and with little if any change of position during the entire period. Apparently all

eggs in an egg pod may be reached by the ovipositor in such cases. Usually less than a half hour elapses before the ovipositor is withdrawn completely.

More than one Scelio egg may be placed in an Oxya egg and all hatch, but only a single parasite develops.

Parasitized Oxya eggs exhibit minute brownish spots where the Scelio ovipositor has been inserted.

Age of Oxya Eggs Parasitized:

Contrary to our expectations, Oxya eggs in all stages of development may be successfully parasitized. Vinokurov [4] has observed a Scelio in eastern Siberia which parasitizes certain grasshopper eggs only at the time the grasshopper is placing its eggs in the soil and at no other time. In the early stages of our breeding work with *Scelio pembertoni* and *S. serdangensis,* only Oxya eggs freshly laid or from 2 to 3 days old were used. These were readily parasitized. Later observations with the former species indicated that older eggs may be easily parasitized also. On November 17, 1931, fifty-three unparasitized Oxya egg pods, 14 days old, were exposed to 30 female *Scelio pembertoni* for 24 hours. From these pods parasites began emerging on December 26 and continued emerging almost daily until January 24, 1932, totaling 286 individuals.

A final experiment, using the same species, indicated that mature Oxya eggs, almost ready to hatch, may also be successfully parasitized. On November 19, 1932, twelve Oxya egg pods, 30 days old, were placed on sand in a jar containing 40 Scelio about half of which were females. These were left with the parasites for three days and then isolated in a vial for emergence records. The 12 egg pods contained a total of 196 Oxya eggs. In a few days 132 grasshopper nymphs emerged from eggs unsuccessfully parasitized and on December 27-28 a total of 64 parasites hatched from the balance of the eggs.

A small percentage of *Oxya chinensis* eggs may incubate for from 2 to 7 months longer than their normal period of about 6 weeks. Later observations have shown that *Scelio pembertoni* may successfully parasitize these old, retarded dormant embryos also.

Period of Oviposition:

Oviposition usually begins almost immediately after the emergence of the female. Egg tubes dissected from freshly hatched individuals are always found to contain many mature eggs. Should the parasite fail to locate Oxya egg pods for at least two weeks after emerging it may still successfully accomplish parasitism. Twelve females and a number of males which emerged on December 24, 1930, were held in a test tube for 14 days and fed only honey and water. At the end of this period they were exposed to 8 unparasitized Oxya egg pods for 2 days. Subsequently from these pods 77 parasites were reared. Egg laying usually occurs daily for from 8 to 14 days. Mortality naturally comes sooner with ovipositing females than with those having no opportunity to lay. They seldom live more than 2 weeks when ovipositing daily. Dissection of the egg tubes from such females at the time of death always show few, if any, well-developed eggs remaining.

Number of Eggs Deposited:

A few records have been obtained on the number of progeny of individual females. Eight freshly emerged females were confined in individual jars with several males on December 30, 1930, and daily given fresh *Oxya chinensis* egg pods until all females had died. Each pod was then saved in a separate vial to obtain the emergence record. This experiment continued until January 21, 1931, when the last female died. No progeny were obtained from females after the twelfth day. Most of the eggs were deposited at irregular intervals during the first 8 to 10 days. The following table shows the total number of progeny per female and the daily rate of oviposition. Perhaps in some cases more than one egg would be placed in a single Oxya egg. In such cases the progeny result is always one instead of two or more.

TABLE I

NUMBER OF PROGENY AND DAILY RATE OF OVIPOSITION OF 8 FEMALES (*Scelio pembertoni*)

Date of Oviposition	Number of Progeny No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8
Dec. 30, 1930	....	8	6	....	12	1	....	9
Dec. 31, 1930	2	....	....	....	....	8	2	....
Jan. 1, 1931	12	10	3	....	....	6	....	6
Jan. 2, 1931	1	....	10	....	....	....	....	2
Jan. 3, 1931	2	6	....	19	....	....	....	....
Jan. 4, 1931	1	13	....	....	16	....	1	....
Jan. 5, 1931	....	3	....	....	....	....	....	....
Jan. 6, 1931	....	11	2	10	....	9	....	....
Jan. 7, 1931	....	....	....	....	....	....	3	....
Jan. 8, 1931	7	....	....	1	....	....	4	....
Jan. 9, 1931	5	....	....	1	....	9	....	....
Jan. 10, 1931	....	3	....	....	....	....	....	....
Total	30	54	21	31	28	33	10	17

From Table I it is seen that the greatest number of progeny obtained from a single female was 54. It is probable that under the most favorable conditions in the field this number may be greater, for from 50 to 75 fairly mature eggs can usually be dissected from the ovaries of freshly emerged females.

Parthenogenesis and Proportion of Sexes:

Normal oviposition is accomplished by unmated females. In several tests made, their progeny were always males. This is probably of considerable importance in the continued maintenance of the species, for the proportion of the sexes in field collected material has shown a preponderance of females over males. Parasitized egg pods have been under observation from which nothing but females emerged. The males usually remain over the egg pod after emerging to await the hatching of females, with which they mate immediately. Normally a well-parasitized egg pod will nearly always produce more females than males. During indoor breeding

work in Honolulu in January, 1932, an examination of 481 parasites gave 281 females and 200 males. From egg pods exposed to parasites in field recovery work in Manoa Valley, Honolulu during November, 1932, a total of 121 parasites emerging gave 97 females and only 24 males.

The Egg:

The newly deposited egg is .8 mm. long, broadly oval and terminating at the caudal end in a long slightly curved stalk as shown in Figure 10. The cephalic end is narrowed to a slight tubercle. The entire egg is placed completely within the Oxya egg. The duration of the egg stage was not accurately determined but Oxya eggs parasitized 5 days previously were found to contain Scelio larvae of the first instar.

The Larva:

The newly hatched larva (Figures 11 and 12) is most remarkable and unusual in shape and structure. Apart from the absence of legs, it bears superficially a strong resemblance to members of the collembolid genus Sminthurus. A larva of the scelionid genus Teleas quite similar was described by Ayres[5] in 1884. Packard [6] and Imms [7] consider such larvae to be the result of premature embryonic development which in most other insects would have been passed before the hatching of the egg. Similar first instar scelionid larvae have been described by Balduf,[8] McColloch and Yuasa [9] and Martin [10].

No respiratory or nervous organization is discernible, the digestive tract is blind and no body segmentation is exhibited. It is characterized by well-developed antennal processes and large weakly chitinized mandibles. The abdominal portion of the body bears about 16 strong bristles arising dorso-laterally and an elongate tapering tail-like appendage extending forward beneath the body almost to the head. The function of such processes was not determined, though they probably facilitate locomotion.

The later larval stages of Scello were not seen.

Emergence of Adult:

Scelio adults emerge from the Oxya egg pods by chewing their way out through the corky substance enclosing the eggs. The exit

hole (Figure 14) is usually circular and barely large enough to permit the parasite to escape. An egg pod from which 15 to 20 parasites have emerged usually shows only a few exit holes. Compact, spherical egg pods sometimes have but one exit hole, through which as many as 18 parasites escaped. In general, a parasitized egg mass will nearly always have much fewer emergence holes than the number of parasites it produced.

Emergence mostly occurs between the hours of 9 A.M. and 4 P.M. and less commonly thereafter until sunset.

Longevity:

In laboratory experiments, adults seldom live much over three weeks when fed honey and water and permitted to oviposit. As already mentioned, such individuals usually die in about two weeks. When kept in subdued light and given only water they usually live for about 12 days and rarely over 15 days. Without food or water mortality usually occurs within one week.

Life Cycle:

Life cycle data on 2,755 individuals taken at Serdang and Kuala Lumpur, Selangor, F. M. S., between October 10, 1930, and April 20, 1931, indicated an average period from egg to adult of from 25 to 35 days; the shorter cycle occurring during the warmer weather. These records were mostly obtained with the species *Scelio pembertoni,* though some included *S. serdangensis.* No discernible difference was detected between the cycles of the two species. In the course of breeding the former species in Honolulu, life cycle records on 9,391 individuals have been tabulated during 1931-32. During the warmest weather the period may be as short as 25 to 26 days. During December, January and February, the shortest period from egg to adult is usually from 38 to 40 days.

In every month of the year there is considerable variation in the cycle in any given lot of parasitized egg pods. Any lot of Oxya eggs parasitized on a given date begin producing parasites from 25 to 38 days later, depending upon the season of the year and continue yielding parasites for from 10 to 25 days longer. Table II gives a typical case to illustrate the duration and variability of the life cycle of *Scelio pembertoni.*

TABLE II

Life Cycle of *Scelio pembertoni*

Oxya Eggs Parasitized	Parasites Emerged	No. Parasites	No. Days
Oct. 8, 1931	Nov. 4, 1931	35	27
Oct. 8, 1931	Nov. 5, 1931	180	28
Oct. 8, 1931	Nov. 6, 1931	132	29
Oct. 8, 1931	Nov. 7, 1931	14	30
Oct. 8, 1931	Nov. 8, 1931	12	31
Oct. 8, 1931	Nov. 9, 1931	1	32
Oct. 8, 1931	Nov. 12, 1931	4	35
Oct. 8, 1931	Nov. 13, 1931	5	36
Oct. 8, 1931	Nov. 14, 1931	7	37
Oct. 8, 1931	Nov. 15, 1931	19	38
Oct. 8, 1931	Nov. 16, 1931	13	39
Oct. 8, 1931	Nov. 17, 1931	5	40
Oct. 8, 1931	Nov. 18, 1931	4	41
Oct. 8, 1931	Nov. 19, 1931	2	42
Oct. 8, 1931	Nov. 20, 1931	11	43
Oct. 8, 1931	Nov. 21, 1931	4	44
Oct. 8, 1931	Nov. 22, 1931	2	45
Oct. 8, 1931	Nov. 25, 1931	2	48
Oct. 8, 1931	Nov. 29, 1931	1	52

LITERATURE CITED

(1) Willemse, C. 1925. Revision der Gattung Oxya Serville. Tijdschr. Ent. Vol. LXVIII, pp. 1-60, 65 figs.

(2) Ramachandra, Rao Y. 1921. Oxya velox. Rept. Proc. 4th Ent. Meeting, Pusa, 1921. pp. 41-42.

(3) Timberlake, P. H. 1932. Three New Parasitic Hymenoptera from the Indo-Malayan Region. Proc. Haw. Ent. Soc. Vol. VIII, pp. 153-158.

(4) Vinokurov, G. M. 1927. Grasshoppers and Areas of their Outbreaks in Eastern Siberia. Bull. Irkutsk Plant Prot. Sta. Vol. I, pp. 3-52.

(5) Ayres, H. 1884. On the Development of Oecanthus niveus and its Parasite Teleas. Mem. Boston Soc. Nat. Hist., Vol. III, pp. 225-281, 8 pls.

(6) Packard, A. S. 1898. A Textbook of Entomology. pp. 703-704.

(7) Imms, A. D. 1924. A General Textbook of Entomology. p. 181.

(8) Balduf, W. V. 1926. *Telenomus cosmopeplae* Gahan, An Egg Parasite of *Cosmopepla bimaculata* Thomas. Jour. Econ. Ent. Dec., 1926, pp. 835-837.

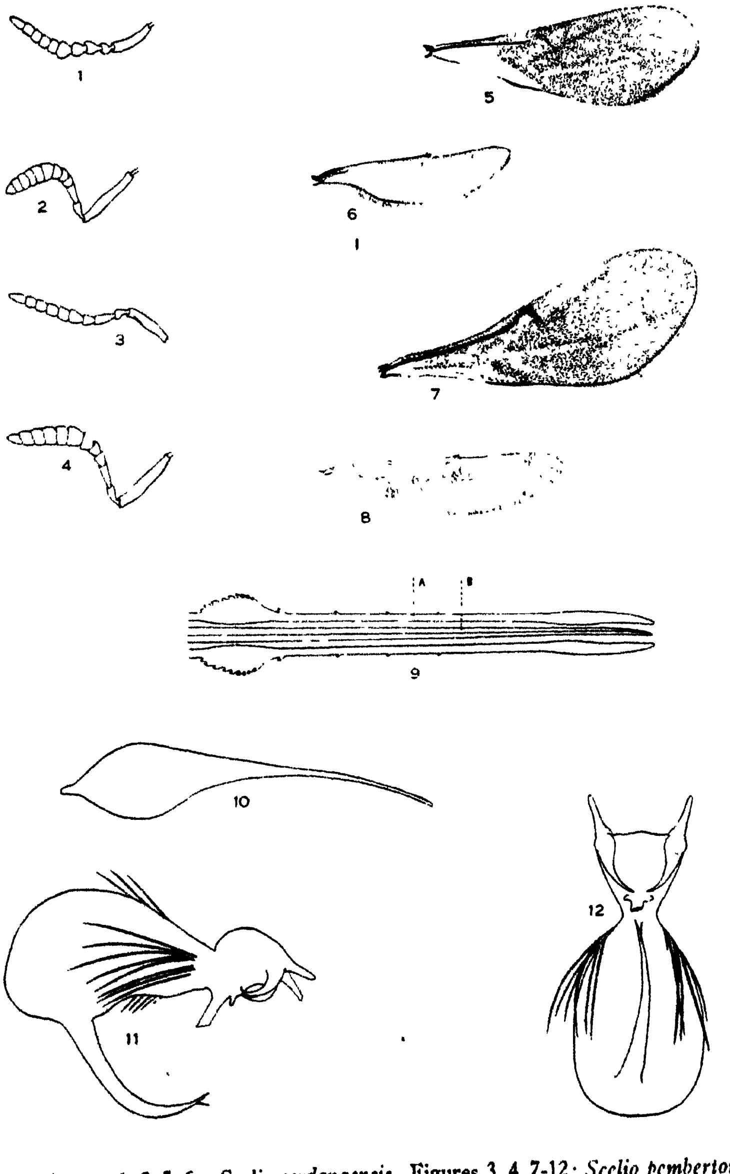
(9) McColloch, J. W., and Yuasa, H. 1915. Further Data on the Life Economy of the Chinch Bug Egg Parasite. Jour. Econ. Ent., Apr., 1915, pp. 250-252, 1 pl.

(10) Martin, C. H. 1927. Biological Studies of Two Hymenopterous Parasites of Aquatic Insect Eggs. Entomologica Americana, Dec., 1927, p. 137, 1 pl.

EXPLANATION OF FIGURES

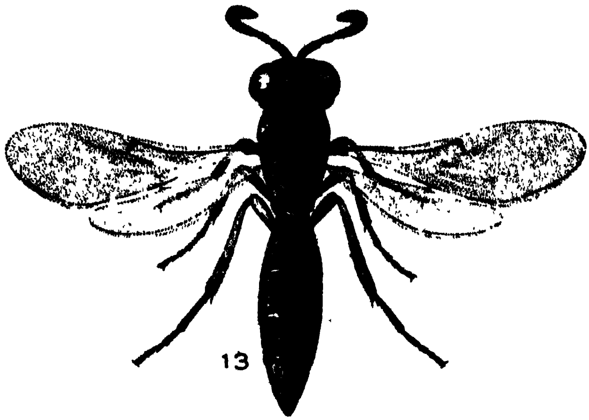
(All much enlarged)

1. Antenna of male *Scelio serdangensis* Timb.
2. Antenna of female *Scelio serdangensis* Timb.
3. Antenna of male *Scelio pembertoni* Timb.
4. Antenna of female *Scelio pembertoni* Timb.
5. Forewing of female *Scelio serdangensis* Timb.
6. Hindwing of female *Scelio serdangensis* Timb.
7. Forewing of female *Scelio pembertoni* Timb.
8. Hindwing of female *Scelio pembertoni* Timb.
9. Distal portion of ovipositor blades of *Scelio pembertoni*.
   A. Stylet. B. Stylet sheath. Length 1.1 mm.
10. Newly deposited egg of *Scelio pembertoni*.
11. Newly hatched larva of *Scelio pembertoni* (lateral aspect).
12. Newly hatched larva of *Scelio pembertoni* (ventral aspect).
13. Female *Scelio pembertoni* Timb.
14. Egg pod of *Oxya chinensis* (Thun.), from which parasites have emerged.
15. Female *Scelio pembertoni*, showing typical position assumed when ovipositing in Oxya egg pod.

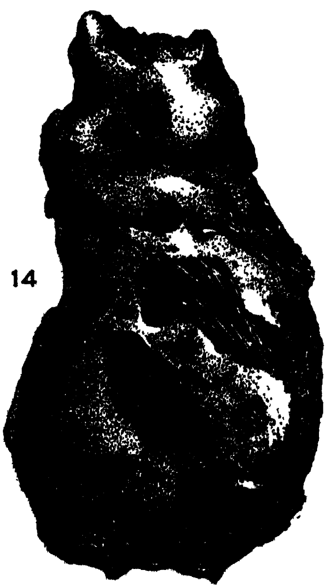


Figures 1, 2, 5, 6: *Scelio serdangensis.* Figures 3, 4, 7-12: *Scelio pembertoni.*

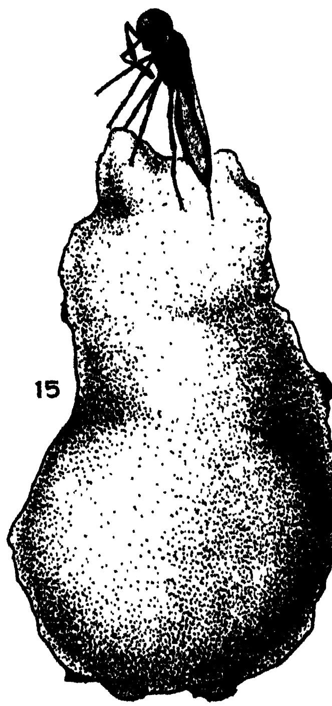
Plate 16



13



14



15

Scelio pembertoni

New Hawaiian Coleoptera, with Notes on Some Previously Known Species

BY DR. R. C. L. PERKINS

Newton Abbot, England

(Presented by title by O. H. Swezey at the meeting of Dec. 1, 1932.)

The eight new species of beetles here described have mostly been sent to me for description by Mr. O. H. Swezey, and amongst them are several extremely interesting forms. The species sent from the Nauhi Gulch on Hawaii seem to be either identical with, or very closely allied to, species found on Haleakala, Maui. Except where otherwise indicated, the types to be deposited in the collection of the Hawaiian Entomological Society.

CERAMBYCIDAE

Plagithmysus sapindi n. sp.

Length (including wings) of two female examplés described, 10-12 mm. General color black, elytra, more or less, paler apically, the metasternum apically, the antennae, tibiae more or less, the tarsi, and the base of the femora rufescent or pale, the latter either blackish or obscurely red. Pronotum clothed with short pale pubescence without definite vittae, the elytra with a conspicuous basal patch of pale hairs towards the shoulders and with a subflavescent pubescence along the flattened sutural part from the apex to rather before the middle of their length, these inconspicuous pubescent lines becoming wider anteriorly where there is an irregular patch or some flecks of denser hairs; there are also other variable flecks of denser pubescence scattered about the elytra.

Face rather densely hairy on either side of the median groove. the antennae with sparse outstanding hairs beneath on the basal joints. Pronotum above dull, almost evenly pubescent, the very dense sculpture not hidden, the central elevation or crest broad and not strong, with two distinct carinae posteriorly and sometimes with an anterior one equally distinct, between these scabrous or tuberculate, and there are similar asperities between the median crest and the sublateral elvations, beneath which the sculpture at the sides of the pronotum is less dense and the surface between the punctures shining. Elytra under a strong lens with coarse dense rugose punctures, finer on the posterior half along the sutural portion, and externally to this somewhat shining. The apices are more or less pale, brown or yellow, and in one of the specimens the yellow color extends broadly along the lateral margin nearly to the middle; scutellum rather densely hairy, metepisterna with a dense apical pubescent spot; sides of the abdominal segments, except the basal, densely pubescent, between these lines very sparsely hairy. Hind femora, except the base, black or blackish red,

clothed evenly with white decumbent hairs, widening very gradually from the base to the apex, hind tibiae with obliquely outstanding black hairs, but at the base with white ones, the tarsi densely clothed with snow-white hairs.

Hab.—OAHU, Niu. Bred from *Sapindus oahuensis,* June 17th and early July, 1932 (O. H. Swezey).

Plagithmysus polystictus n. sp.

Length (including wings) of the single male specimen, 15 mm. General appearance that of *P. munroi* Sharp, with similar rough sculpture of the elytra and long subparallel-sided femora and with a row of well-separated flecks on either side of the suture representing the usual pubescent lines, but the mesopleura and metapleura are almost wholly concealed beneath dense yellowish appressed hairs, the pronotal vittae are more distinct and definite, the lateral ones narrow and the sides below them glabrous. This species is easily distinguished from *munroi* by the distinctly punctured, non-pubescent sides of the pronotum, strongly contrasted with the dull black and very densely punctured parts above and the metasternum, though less densely haired posteriorly than in *munroi,* has a large and very dense yellow patch on each side in front. In the *munroi* examined by me there are some sulphur-yellow flecks on the elytra contrasting with the white ones, but in the new species the flecks are practically all white.

Hab.—KAUAI, Kumuwela. Collected from the trunk of a *Cryptocarya mannii* tree, July 7, 1932 (O. H. Swezey).

Neoclytarlus atricolor n. sp.

Length of the single female described, 14 mm. One of the larger species, dull black and very densely finely sculptured over the whole upper surface; the pronotum has no conspicuous or well-defined vittae; the elytra have each a narrow line of white pubescence along the suture from the apex to near the middle of their length, where the lines diverge outwardly to form a furcation, but this is feebly developed and may perhaps sometimes be wanting; the base of the femora is not pale, but at most obscurely reddish.

Head thinly clothed with pale hairs, but more densely on either side of the middle facial groove, the outstanding hairs of the antennae extremely short and sparse. Pronotum gently rounded at the sides, finely and very densely punctured or granulately sculptured, the median elevation or crest broad and the surface scabrous, but without the usual distinct transverse lines or carinae; between the median elevation and the indistinct sublateral ones there is a very feeble linear development of scanty pale hairs, which along the front and hind margins are more developed and connect with the lines which border the lateral ridges; beneath these there is a small smooth area with the sculpture almost obsolete. The scutellum appears to be only sparsely clothed with white hairs and there are a few on either side of the suture a little behind it; there is also a patch at the extreme base of the elytra towards the shoulders, in addition to the furcate lines described above; the sculpture of the elytra is fine and extremely dense all over and apart from the rugulose punctures, except on the apical part, there is much shallow and irregular sulcation of the surface. There is a dense patch of yellowish hair at the apex of the metepisterna and similar dense hair along

the sides of the abdomen, between which the clothing is less dense and whiter. Hind femora clothed with short depressed pale hairs and becoming gradually thickened from the base to near the apex, when they become conspicuously narrowed to the tip, the hind tibiae with short, inconspicuous hairs.

Hab.—HAWAII, Nauhi Gulch, 8500 feet elevation, October 3, 1931; bred from *Vaccinium pelcanum* (F. X. Williams).

CURCULIONIDAE, COSSONINI

Oodemas rubicola n. sp.

Length, 3.75-5 mm. Elongate-ovate, rather narrow in form, very bright bronzy metallic, shining, with rufescent antennae, the legs varying from red to nearly black in color; second joint of front tarsi in the male considerably larger than in the female, the lobate third joint large; second joint of the antennae, seen at its longest, about equal to the third, but shorter than this. Head with moderately long rostrum, which is at most very slightly wider in front of the antennae than behind them, and is finely, but generally subrugosely punctured, the eyes depressed or hardly at all convex, the antennae moderately long, the scape about equal to the next four joints in one measured male, and to rather more than five in a female, the two first funicle joints quite elongate, the third much shorter, nearly round, and the following ones nearly equal to it in length, but tending to become wider towards the club. Pronotum with fine or very fine punctures. Elytra with rows of remote and feeble punctures and without definite striation, the interstices with still finer feeble punctures, from which in well-preserved and clean specimens minute pale setae are (under a strong lens) seen to arise and to form more or less distinct rows. The sculpture as in many other species varies somewhat, both as regards the punctures themselves and the minute surface sculpture between them.

This species in its comparatively narrow form approaches *O. graciliforme* Perkins of Kauai, but is more closely allied to the Rubus-frequenting species of Maui, *O. chrysodorum* Perkins. Apart from its rather smaller size and darker color, the rostrum is less evidently widened apically and generally more finely sculptured than that of the latter, while the front tibiae are less robust; nor does it agree with the other allied Maui species which either habitually or occasionally occur on Rubus.

Hab.—HAWAII, Nauhi Gulch, 5000-6000 feet elevation, in dead stems of *Rubus hawaiiensis,* September 28, 1931 (Swezey and Williams). I have examined six examples of this species.

Oodemas viridipenne n. sp.

Length about 5 mm. Oblong ovate, robust, with a brilliant brassy green tint, very shining, the antennae and tarsi rufescent; elytra with rows of

strong, fairly regular punctures, the interstices finely and clearly punctured, the sides moderately rounded from the base and a short distance before the apex, at a point where their width is about equal to that at their basal margin, strongly sinuate inwardly to the rounded tip, so that the apical portion is more strongly and abruptly narrowed than in other species. Rostrum rather finely, subrugosely punctured, not at all widened in front of the antennae, which are slender, the scape not quite so long as the width between their insertion, the first and second joints of the funicle elongate and about equal, the funicle as a whole not stout. Pronotum shining, finely and remotely, but distinctly, punctured. Elytra very strongly shining, the punctures in the series deep and as if placed in shallow wide grooves, the interstices, which are very conspicuously punctured, in some aspects appearing quite convex, as if their surface sloped down from the middle to the row of punctures on either side. The sex of the single specimen is uncertain, the front tarsi having the second joint by no means broad, while the lobes of the third joint are of moderate size. The shape of the elytra which are broad and abruptly narrowed behind and of a brilliant greenish metallic color will distinguish this species from any other on Hawaii.

Hab.—HAWAII, North Kona, 3000-4000 feet, 1902 (Perkins). Type in my collection, to be sent later to the Bernice Pauahi Bishop Museum.

Oodemas corticis Perkins.

As I had expressed some doubt of the occurrence of this species on the Island of Hawaii, Mr. Swezey kindly sent over for my inspection four specimens captured in Nauhi Gulch and determined by himself, quite correctly. These specimens as compared with my series from Maui, Molokai and Lanai are of distinctly larger size and generally more shining. So far as I can judge from the limited number of specimens now available, the Lanai and Molokai examples differ slightly in sculpture from the typical Maui form, and with that from Hawaii may form two distinct races, but large series will be required to show how far the differences are constant, owing to the variability of so many species in this genus.

Hab.—HAWAII, Nauhi Gulch and Keanakolu, 5000-6000 feet, October 2-4, 1931, in standing dead koa trunks (Swezey and Williams). Previously recorded from Maui, Molokai and Lanai.

Oodemas solidum Perkins.

Many years ago, I obtained in North Kona a single specimen of an Oodemas which appears to be a small example of *O. solidum*, a species locally common on Haleakala, Maui. At the time of capture it was overlooked amongst a number of *O. konanum* Per-

kins, though its more brilliantly metallic elytra render it distinct even on superficial inspection.

Hab.—HAWAII, N. Kona, 3000-4000 feet. Previously recorded from Haleakala, Maui.

Oodemas paludicola n. sp.

A species of moderate size, 4-5 mm. long. Nigroaeneous, the antennae and sometimes the tarsi rufescent, ovate, not much shining, but the elytra more or less so. Under a strong lens the minute surface sculpture between the punctures both on the pronotum and the elytra is very distinct, the latter with the interstices conspicuously convex at least towards the sides and on the apical portion, so that most of the series of punctures are placed in well-marked grooves. Rostrum with the sides nearly parallel, the apical part not noticeably widened, more or less rugosely punctured and in some aspects appearing longitudinally carinated basally in the middle. Antennae moderately long and slender, the scape about as long as the width of the rostrum between their insertions, the second joint stouter and generally appearing shorter than the elongate third joint, but in some aspects it is really hardly shorter than the latter, the funicle as a whole not stout, but slightly thickening towards the club. The eyes are hardly at all convex. Pronotum generally dull, owing to the well-developed surface sculpture between the very fine but distinct and almost evenly distributed punctures. Elytra with the serial punctures generally remote from one another and often more or less ill-defined and irregular, but variable in different individuals, the interstices finely and conspicuously but not densely punctured and, in addition to the extremely minute sculpture, more or less traversed by very fine sulci. In lateral view of the insect the interstices to a large extent appear to be strongly raised from the serial punctures so as to be strongly convex or subcarinate. The male has the second joint of the front tarsi rather broader than in the female, but the tarsal characters are not very marked and the lobate third joint is of moderate size.

This species is described from several examples taken in company under moss-covered bark of a dead tree and though their most conspicuous specific character is found in the convex form of the interstices of the elytra, yet one specimen in this same batch is without this character. Otherwise it agrees with its companions so well that I have no doubt it is of the same species.

Hab.—MOLOKAI, in the very wet forest above 4000 feet, February, 1902 (Perkins). Type in my collection, to be sent later to the Bishop Museum.

CURCULIONIDAE, OTIORHYNCHINI

Rhyncogonus welchii n. sp.

The single example described is 18 mm. long. Shining black, the eyes compared with those of most species only feebly convex, the elytra each

with a very dense whitish longitudinal vitta of scaly appressed hairs extending from the base nearly to the apex, the inner margin of this vitta coinciding with the fifth row of punctures from the suture; there is a conspicuous basal patch between this vitta and the suture, while some other spots or flecks are also present and the pseudepipleura are to a considerable extent covered with similar dense appressed clothing. At the sides the elytra are explanate from the shoulders, so that a sharp carina separates off the pseudepipleural portion, their apical part is narrowly produced or subacuminate and bifid at the tip. Rostrum thinly clothed with pale hairs and with a denser tract of stouter ones along the eye-margins, carinated in the middle longitudinally and also on either side along the scrobes up to the eyes, rugosely punctured. Pronotum above thinly clothed, but more densely towards and on the side, rugosely punctured, the surface between the punctures smooth and shining and in parts forming some largish impunctate areas, in the middle posteriorly with an impression. Elytra with a very shining surface, the punctures in the rows bearing each a decumbent seta, smaller than those which form the bands, spots and flecks. Inwardly to the longitudinal vittae the rows of punctures are definite, but outwardly to these they are confused. Abdomen beneath densely punctured, the basal segment largely depressed, the two intermediate and the apical segments more densely, almost evenly pubescent, the last very densely finely punctured. The legs are almost evenly clothed with pale decumbent hairs. Antennae with the first funicle joint notably longer than the second, which is more than twice as long as its greatest width, the third considerably shorter than the second and only about twice as long as wide, the following joints subequal, the basal joint of the club about twice as long as wide and much longer than the last funicle joint.

This beautiful and striking species is allied to some of those on Kauai rather than to those on Oahu. I have great pleasure in naming it after its discoverer, who obtained it while collecting land shells for the Bishop Museum. Mr. Swezey, who submitted the insect to me for description, tells me that the area in which it was found may now be closed to collectors as it is part of a large region included in a U. S. Naval Reservation, and it may not be possible to visit the locality again.

Hab.—OAHU, Waianae Mts., Lualualei, Halona Valley, in the 4th gulch southwest of Pohakea Pass, about 1600 feet elevation, from an unidentified shrub or small tree, September 25, 1932 (d'Alté A. Welch). Type to be deposited in the Bishop Museum.

CIOIDAE

Cis parittii n. sp.

Length about 1.5 mm. Cylindrical, black or castaneous, the antennae, mouth parts, legs and front of pronotum generally rufescent or paler in color, shining and appearing glabrous except under a very strong lens or compound microscope, when each puncture is seen to bear a minute pale seta.

The whole insect is densely punctured above, the male with a well-developed angular prominence on each side in front of the eyes, the ridge forming these being more rounded and less developed in the female. Antennae with the club generally infuscate or darker than the rest, its basal joint not much smaller than the second. The prosternum is distinctly margined at the sides and behind; the lateral margins in strict dorsal aspect appear wider towards the hind angles, where the pronotum is widest, the sides being very slightly convergent forwards from these or nearly parallel and then at the anterior third or fourth of its length it becomes much narrowed. The punctures are dense and the surface generally shining, but one of the specimens examined has the pronotum dull, with the very dense minute sculpture between the punctures quite distinct under a strong lens. The elytra are shining and densely punctured, as a rule distinctly paler in color on the apical part.

This minute species is very different from any other of the Hawaiian series, but on account of its small size, copious punctuation and the facial processes of the male might be compared with *C. porcatus* Sharp. That species, however, has a very different clothing and the basal club-joint of the antennae is much smaller as compared with the second, apart from other differences, and the two are not allied. I first noticed this species on the *hau* trees along the Tantalus road not long after houses were built in that neighborhood and suspected that it might be an introduced species.

Hab.—OAHU, Waimanu, on *hau*, under rotten bark, November 22, 1931 (Swezey). Tantalus, on *hau* trees (*Paritium tiliaceum*) about 30 years ago, when it was also collected by W. M. Giffard with me.

Cis porcatus Sharp.

Five specimens (one of which had become detached from the point and could not be found on arrival) of what I have considered a small narrow form of this variable species, were sent by Mr. Swezey. All the specimens are immature and were collected on *koa* in Palolo, Oahu, February 23, 1932. I have taken exactly similar specimens, sometimes in company with larger and more typical ones, on Oahu and have considered these to be a variety of *porcatus*. In some localities this species is often of a reddish color and it varies a good deal in form, and also in sculpture and clothing. Possibly several races may prove to be distinguishable, when it has been specially collected. It is one of the commonest Hawaiian beetles.

Cis laeticulus Sharp.

A single specimen with red head and thorax and the apical portion of the elytra also red was taken on staghorn fern at Kahauiki, Oahu by Swezey, October 16, 1927. This is not an uncommon variety of this rather variable species. I have found this species frequently on the surface of dead fallen leaves especially of Freycinetia, but it is also obtained from standing trees. It has occurred to me on Molokai, Maui and Hawaii (Kona district) in addition to the localities given in the "Fauna."

Cis dracaenae Perkins.

A specimen which I took from a Pipturus tree near Mt. Tantalus has not the pale suture of the elytra as described in the type. I came across this specimen only recently.

Apterocis subaeneus Perkins.

A series of specimens was obtained from a "bracket fungus" on *Acacia koa* in Nauhi gulch, Hawaii, October 2, 1931, by Swezey and Williams, at an elevation of 5000-6000 feet. These seem to agree with the description of the above species described from Maui, though the slight aeneous tinge of the thorax is not always evident. I obtained similar specimens in North Kona, at 4000 feet, many years ago. They are perhaps on the whole darker in color than those from Nauhi gulch. A single specimen collected at 3000 feet on Haleakala, Maui, has the pronotum entirely testaceous or rufescent except for an anterior median and a pair of posterior sublateral infuscations. The punctures of this part are more distinct and definite, the surface being hardly at all strigose. This may prove to be a distinct species.

Hab.—HAWAII, Nauhi gulch (Swezey and Williams). N. Kona at 4000 feet (Perkins). Previously described on a single specimen from Haleakala, Maui, 5000 feet, where at a lower elevation (3000 feet) an allied form, but probably a distinct species was taken.

New Records of Insects on Molokai, and Miscellaneous Notes

BY O. H. SWEZEY

(Presented at the meeting of September 1, 1932)

Bactra truculenta Meyrick.

The nutgrass moth was taken at light at Kaunakakai, June 6, 1932. It is the first record of its occurrence on Molokai.

Monopis meliorella (Walker).

This tineid was taken at light at Kaunakakai, June 6, 1932, and is the first record of its occurrence on Molokai.

Polynema reduvioli Perkins.

Four of this egg-parasite of Reduviolus were reared from *Chaetochloa verticillata* grass, collected at Kaunakakai, June 6, 1932. No doubt the grass stems contained eggs of *Reduviolus capsiformis* (Germ.), as this bug was observed to be present where the grass was collected. It is the host for this mymarid. The parasite was not previously recorded from Molokai.

Leptomastidea abnormis (Girault).

Three of this parasite were reared from *Pseudococcus kraunhiae* (Kuwana) on seed pods of *Stictocardia campanulata,* at Mapulehu, April 4, 1932. It had not previously been recorded from Molokai. From the same material, two *Pauridia peregrina* Timberlake also issued. Both are parasites on the mealybug.

Marietta graminicola Timberlake.

This parasite issued from *Trionymus insularis* Ehrhorn, collected at Kaunakakai, June 6, 1932. It is considered to be a hyperparasite of mealybug parasites.

Oxacis collaris (Sharp).

This oedemerid beetle was quite common at light at Kaunakakai, Molokai, June 6, 1932. An undetermined species of Ananca was also collected at light at the same time.

Crocidosema lantana Busck.

This tortricid moth was found infesting pods of *Bignonia chrys-*

antha at Kaunakakai, June 6, 1932. *Tecoma stans,* a closely related plant, has been reported with terminal twigs bored by larvae of this moth in Honolulu, several times in recent years.

Chloridea obsoleta (Fab.).

A caterpillar of this moth was found feeding on Euxolus at Mapulehu, June 6, 1932. This is an addition to the numerous host plants of this moth.

Argyroploce illepida (Butler).

Several of this moth issued from fruits of *Sapindus oahuensis* collected on Niu Ridge, June 4, 1932. It is probably a new host record for this moth.

Cosmophila vulpicolor Meyrick.

Two of this moth matured from caterpillars collected on *Osteomeles anthyllidifolia* on Niu Ridge, June 4, 1932.

Plagithmysus cuneatus Sharp.

Several specimens of this beetle matured from larvae collected on *Sapindus oahuensis* on Niu Ridge, June 4, 1932. Two beetles also issued from the same material, which proved to be a new species, as yet unnamed.*

Vanessa atalanta (Linn.).

A ragged specimen of this butterfly was collected on Kumuwela Ridge, Kauai, June 27, 1932. This is the first record of this butterfly on any of the Islands except Hawaii, where it has been known for quite a long while.

Tromatobia rufopectus (Cresson).

Five of this parasite issued from a spider egg-cocoon collected on a leaf of *Dianella odorata* at Kumuwela, Kauai, June 25, 1932. There were five dead pupae remaining in the same egg-cocoon. This is the same parasite reported by Mr. Rosa at a previous meeting as having been reared from an egg-cocoon of *Argiope avara.* The identity of the Kauai spider egg-cocoon is not known, but it was not Argiope.

* Described by Perkins on page 265 of this issue. [Ed.]

An Ant New to the Fauna of the Hawaiian Islands

BY WILLIAM MORTON WHEELER

Institute of Biology, Harvard University

Dr. F. X. Williams recently sent me several specimens of a singular, hypogaeic ant which he found during April, 1932, "off the road to Puna, south of Olaa, Hawaii, under moss, etc." It represents a variety of *Strumigenys (Cephaloxys) membranifera* Emery, which was described in 1869 from a single worker taken at Portici, near Naples by the late Professor Emery's brother (Fig. 1a-c). In 1890 Emery described a second form as subsp. *simillima*, also from a single worker, taken on the island of St. Thomas in the West Indies, and four years later Forel described a var. *santschii* from Kairouan, Tunis. Recently (1931) Dr. Marion R. Smith recorded *simillima* from various localities in the state of Mississippi with the remark: "Undoubtedly this subspecies occurs throughout the Gulf States certainly as far west as the Mississippi River."

Many years ago Dr. F. Silvestri sent me five workers of the typical *membranifera* which he had taken in the type locality, near his laboratory at Portici. I have not seen the Tunisian var. *santschii.* Forel described it as differing in its more opaque ferruginous color (though Santschi describes it as "pale yellow"), in having the head more strongly and more irregularly sculptured, with more sharply rectangular anterior corners and the pronotum as having more accentuated marginate borders. I have not seen topotypic specimens of *simillima.* According to Emery, its head is somewhat more elongate and more narrowed anteriorly than that of the typical *membranifera*, with the median post-clypeal impression, or frontal area larger and more pronounced, the antennal funiculi longer and with the terminal joint scarcely longer than the preceding joints together. These differences are shown in his figures (here reproduced as Figure 1b and d).

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Compared with the typical *membranifera,* the worker of the Mississippi form, which Dr. Smith and I referred to *simillima,* exhibits the following differences in addition to those mentioned by Emery: the pronotum is distinctly broader, with more pronounced anterior and lateral margination and smoother and more

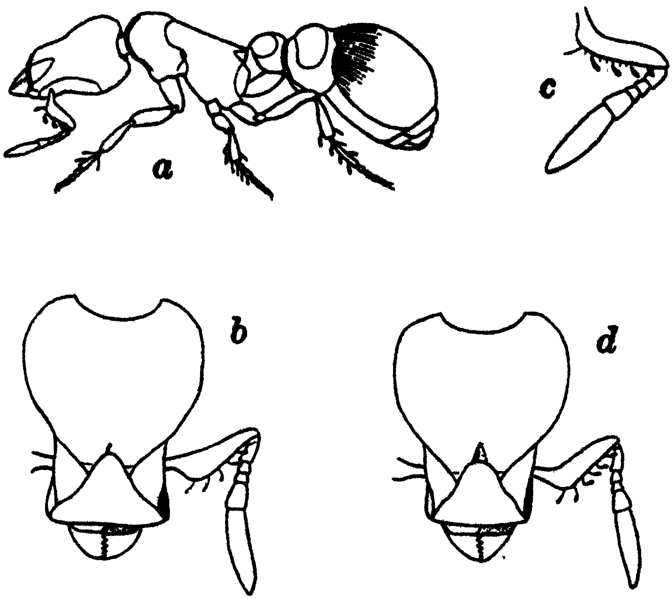

Figure 1. *Strumigenys (Cephaloxys) membranifera* Emery. *a,* worker; *b,* head; *c,* antenna; *d,* dorsal view of head of the subspecies *simillima* Emery. (After Emery)

shining surface, the body is of a distinctly deeper ferruginous color, the clavate hairs of the vertex, antennal scapes, legs, venter and tip of gaster and the spongiform appendages of the petiole and postpetiole are more sordid and not pure white as in the typical Italian form. Since these characters are not mentioned by Emery the Mississippi form may be regarded, at least provisionally, as a distinct variety, for which I suggest the name *marioni* var. nov.

The worker specimens taken by Dr. Williams in Hawaii and which I shall call var. *williamsi* var. nov., closely resemble those

of *marioni* in color and in the shape of the head, but the pronotum as well as the remainder of the thorax seem to be even smoother and more shining, and the umbilicate punctures of the head somewhat more discrete and more regular. The impression representing the frontal area, however, is small and indistinct as in the typical *membranifera*. The hairs and spongiform appendanges are distinctly yellow.

A single deälated female differs from the worker in having the head broader, with much more pronounced, sharply rectangular anterior corners. Thorax short, highest through the scutellum; humeri of pronotum, which is not marginate as in the worker, forming a pair of rounded protuberances; mesonotum small, convex, longer than broad, narrowly rounded anteriorly; base of epinotum shorter than the declivity and forming nearly a right angle with it in profile. Petiolar and postpetiolar nodes broader than in the worker, the former transversely subrectangular, nearly twice as broad as long. Sculpture as in the worker but the thorax subopaque; pronotum finely rugulose; mesonotum and scutellum covered with dense umbilicate punctures like those on the head; mesonotum with a few clavate hairs on its lateral borders. Ocellar area infuscated. In other respects very similar to the worker. Length about 1.5 mm.

The distinguishing characters of the various forms of *membranifera* are so slight that their precise taxonomic rank cannot be determined without additional material. Emery confesses that he would not have regarded *simillima* as a subspecies if the type had been taken in Europe. I am inclined to regard it as a mere variety like *santschii*, but if the geographical distribution instead of the slight and elusive characters of the four forms is stressed, they might all be regarded as incipient subspecies.

Like the other small species of Dacetonine ants belonging to Acanthognatus Mayr, Strumigenys F. Smith, Cephaloxys F. Smith, Epitritus Emery, Glamyromyrmex Wheeler, Codiomyrmex Wheeler, Codioxenus Santschi, Pentastruma Forel, etc., *membranifera* is a member of Silvestri's "microgenton," the curious fauna of minute, poorly pigmented, blind or myopic organisms which inhabit the soil and are rarely taken at the surface except after

abundant rains. Hence the precise limits of distribution of any of the species of the genera and subgenera above mentioned cannot be defined at the present time. The whole cosmopolitan tribe Dacetonii is evidently both very ancient and very highly specialized. Now that the Berlese and Silvestri funnels are being more generally used by collecting entomologists, our knowledge of these very interesting ants should increase rapidly.

ANNUAL ADDRESS

The Causes of Fluctuations of Populations of Insects

ROYAL N. CHAPMAN

(Presented at the meeting of December 1, 1932)

The fluctuations of insect populations and the levels which they attain are of primary interest to society in general, for they often determine the value of our crops, the welfare of our domesticated animals and the health of our communities. The environmental factors which influence these population levels and their fluctuations, and the mechanisms through which they act upon the populations are of primary importance to the entomologist.

Fifteen years ago, when I first became interested in this subject and became convinced that it was of the greatest importance in entomology, I searched the literature for titles pertaining to it. However, one of the most interesting and stimulating papers that I found was not indexed in such a way that I could find it in my systematic search of papers on populations. I stumbled upon it accidentally. It was under the title "Presidential Address" by F. Muir of the Hawaiian Entomological Society, delivered on the 18th of December, 1913. Muir considered the effect of parasites and predators upon populations and the struggle for existence. By a few simple arithmetical calculations he showed the theoretical trends of hosts with and without parasites, and illustrated the rôle which predators might play in maintaining populations at a constant level.

Since this time a considerable amount of literature has accumulated on this subject. In general we might divide this literature into two groups: the one written from a viewpoint which is primarily mathematical, and the other group written by biologists whose considerations have been based mainly upon observational data and whose conclusions have been reached largely through philosophizing on the basis of their observations. There have been a few biologists who have indulged in enough mathematics to

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make it difficult to know to which group their papers belong; but in general the biologists have revolted against the mathematics. They have had the general feeling that these phenomena are too complicated to be represented by mathematics. On this point I cannot resist the temptation to digress and call your attention to a quotation from the classic works of Fourier, the French savant who was faced with the same argument when he was struggling with the application of mathematics to thermodynamics. He was faced with the contention that mathematics was applicable to surfaces and solids and not to anything as diffuse as heat and its transmission, just as we are now faced with the contention that mathematics may be applied in engineering, but not to such problems as the biotic control of insect pests.

"Profound study of nature is the most fertile source of mathematical discoveries. Not only has this study, in offering a determinate object to investigations, the advantage of excluding vague questions and calculations without issue: it is besides a sure method of forming analysis itself, and of discovering the elements which it concerns us to know, and which natural science ought always to preserve: these are the fundamental elements which are reproduced in all natural effects.

"We see, for example, that the same expression whose abstract properties geometers had considered, and which in this respect belong to general analysis, represents as well the motion of light in the atmosphere, as it determines the laws of diffusion of heat in solid matter, and enters into all the chief problems of the theory of probability.

"The analytic equations, unknown to the ancient geometers, which Descartes was the first to introduce into the study of curves and surfaces, are not restricted to the properties of figures, and to those properties which are the object of rational mechanics; they extend to all general phenomena. There cannot be a language more universal and more simple, more free from errors and from obscurities, that is to say more worthy to express the invariable relations of natural things.

"Considered from this point of view, mathematical analysis is as extensive as nature itself; it defines all perceptible relations, measures times, spaces, forces, temperatures; this difficult science

is formed slowly, but it preserves every principle which it has once acquired; it grows and strengthens itself incessantly in the midst of the many variations and errors of the human mind.

"Its chief attribute is its clearness; it has no marks to express confused notions. It brings together phenomena the most diverse, and discovers the hidden analogies which unite them. If matter escapes us, as that of the air and light, by its extreme tenuity, if bodies are placed far from us in the immensity of space, if man wishes to know the aspect of the heavens at successive epochs separated by a great number of centuries, if the action of gravity and of heat are exerted in the interior of the earth at depths which will always be inaccessible, mathematical analysis can yet lay hold of the laws of these phenomena. It makes them present and measurable, and seems to be a faculty of the human mind destined to supplement the shortness of life and the imperfection of the senses; and what is still more remarkable, it follows the same course in the study of all phenomena; it interprets them by the same language, as if to attest the unity and simplicity of the plan of the universe, and to make still more evident that unchangeable order which presides over all natural causes."

To agree with Fourier it is not necessary to forget the extreme complexity of our subject matter. A divergence of interest along the two lines indicated is quite natural. We have on the one hand the problem of devising the mathematical expressions which indicate all the possible relationships which may arise. In these expressions it is expedient to use quite arbitrary values to represent the numbers of organisms present and the rates of their development. On the other hand, to apply these mathematics, it is necessary to devise means determining how many organisms are present and how rapidly they are developing. Appalled though we may be by the complexity of the problem we, as entomologists, are committed to it. Our attempts to control the populations of insect pests may be likened to the efforts of the alchemists of old, rather than to the rational procedure of a modern engineer in synthetic chemistry. I say this as an admission rather than as an accusation, for I am directing an experiment station that has three expeditions exploring for parasites at the present time. We are willing to try anything in the hope that we may produce a pot of gold in a

pineapple field. I see no other way of proceeding at the present time, neither do I see way of escape from the perplexing problem of the behavior of populations with which we are faced. If we are to uphold our branch of science we must get away from trial and error.

It will not be possible to make a complete survey or give an exhaustive discussion of all the literature on this subject. Following Muir we have Thompson calculating the trends of host and parasite populations in order to determine what the possibility of control would be if different parasites were introduced for certain pests. It is true these calculations of the number of generations required for parasites to overcome hosts are highly theoretical. On the other hand, in the development of these theories Thompson called attention to many fundamental phenomena and many interesting conceptions of population phenomena. The argument of many biologists that it is too theoretical is not to be given too much attention for we may be reminded that the science of physical chemistry rests fundamentally upon the work done by Willard Gibbs, which even at the time of its publication was considered to be too theoretical to be of any particular value.

The most encouraging development in the application of mathematics to the phenomena of animal population is the advent into the field of the distinguished mathematician, Professor Vito Volterra, of the University of Rome. His interest was attracted to the field through a conversation with M. D'Ancona, who had been studying the fluctuations of the populations of fish in the Adriatic Sea. A summary of Volterra's work up to 1928, translated into English, has been included as an appendix to my volume "Animal Ecology." Since that time his theories have been further developed and presented in a series of lectures at the Sorbonne in Paris. They have appeared in printed form under the title "Lecons sur la Théorie Mathématique de la lutte pour la vie," published in 1931.

I would grant the contention of the biologists that Volterra has made many assumptions with regard to the forces of reproduction and death. However, we must admire the logic in his treatment of the subject, beginning with the biological association of two species which contend for the same food, the consideration of association

of two species, one of which feeds upon the other, and his addition of one complicating factor after another until he comes to the case of any number of whatever species, some of which feed upon others, and finally his treatment of conservative and dissipative biological association.

Among his deductions are included what he calls the three fundamental laws of fluctuation. They are stated as follows:

1. *Law of the Periodic Cycle.*—The fluctuations of the two species are periodic, and the period depends only upon the coefficients of increase and decrease and the initial conditions.

2. *Law of the Conservation of the Averages.*—The averages of the numbers of individuals of the two species are constant whatever may be the initial values of the numbers of individuals of the two species just so long as the coefficients of increase and decrease of the two species and those of protection and of offense remain constant.

3. *Law of the Disturbance of the Averages.*—If an attempt is made to destroy the individuals of the two species uniformly and in proportion to their number, the average of the number of individuals of the species that is eaten increase and that of the individuals of the species feeding upon the other diminishes.

These deductions are worthy of our consideration. Do the numbers of populations of two species fluctuate periodically when other conditions are remaining constant? Will the numbers of individuals of a species rise to a point of saturation if conditions remain constant? If we use some mechanical or chemical means of combating an insect pest and destroy the pest and its parasites together, will the result be an increase in the pest and a decrease in its parasites?

The only constructive reaction to these propositions is to formulate a method of experimentation whereby the truth or fallacy of Volterra's deductions can be demonstrated. Some biologists, notably those of the school of Raymond Pearl, of Johns Hopkins University, have been attempting to express in mathematical form the results of various experiments with populations. Gause (1932) of the Timiriasev Institute for Biological Research, Moscow,

Russia, is one of these. He has formulated expressions of the effect of various environmental factors upon the populations of *Tribolium confusum*, grasshoppers and yeasts.

Turning our attention now to the entomologists themselves, we find a group in Germany interested in the general phenomena of population growth, particularly as it affects outbreaks of insects. Martini (1931), Zwolfer (1932), Bodenheimer (1930), and Eidmann (1931) have published papers based mainly upon evidence gathered during epizoötics of insects. In the main they, like other zoologists, have looked to great changes in physical factors to explain the changes in population levels. Eidmann is inclined to agree with Elton that sun-spot cycles have a profound influence upon the fluctuations of animal populations. From his study of the outbreaks of certain forest insects he has concluded that they are correlated with sun-spot maxima. He believes these come in general about every ten years, and that every third one represents a high maximum. Such phenomena obviously are not subject to experimental verification; and the whole matter of sun-spot cycles and its effect upon biological phenomena rests upon a rather uncertain foundation.

Not only have many entomologists looked to the physical factors for explanation of the changes in population levels, but some of them have contended that physical factors are the only causes of fluctuations of populations; and have even denied that a condition of equilibrium between various members of a population could exist. Such problems, however, cannot be settled by assertions or denials. Neither can satisfactory proof come from observations on fluctuations of populations in the past. Conclusive evidence must come from careful experimentation. With this in mind a search was made for an insect which would be susceptible to laboratory experimentation. It should live in a stable environment; its food should not be perishable. It should be small so that large numbers could be kept in a small space and it should develop rapidly, passing through many generations in a short period of time. After the consideration of many species, the confused flour beetle, *Tribolium confusum*, was selected.

Since that time a group of students has worked with populations of this beetle under controlled conditions to determine

whether there was a hope of confirming the hypothesis of biotic potential and environmental resistance through the use of this species. In the field of genetics Drosophila was chosen for intensive study, with the result that the inheritance of characters was not only traced to specific chromosomes, but genes were described and located, and their behavior recorded. More significant still, the fundamental principles derived from the study of Drosophila were found to hold not only for other animals, but for plants as well.

The ambitious program for the intensive study of Tribolium populations, therefore, got under way with the hope that generalizations might be made which would apply in insects in general. It was shown (Chapman, 1928) that populations of Tribolium under controlled conditions would come to a point of saturation and maintain this with only slight fluctuations. This was regardless of whether the population was high or low at the start, or whether the environment was large or small. This substantiated Volterra's "first law" of the fluctuations of populations.

Proceeding to the analysis of the situation, Sweetman and Palmer (1928) showed that in a medium of whole-wheat flour the development of *Tribolium confusum* was very constant when temperature and moisture remained constant. It was shown that the addition of excess wheat embryo or other food accessories to the medium made no difference in the rate of development so long as the whole-wheat flour was used as a ration. It was thus demonstrated that the environmental factors of temperature, moisture and food could be satisfactorily controlled to the point of producing a constant effect on the beetles.

Chapman and Baird, unpublished manuscript, made a study of the biotic constants of Tribolium over a series of temperatures with controlled relative humidity. It was found that when dealing with populations of Tribolium, the times for the hatching of a group of eggs, the development of larvae and of pupae were very constant. Indeed, the coefficients of the various phenomena were quite comparable with those of physical processes. Experiments with the growth of populations under different conditions of temperature have shown that the rate of increase of a population is very precisely correlated with the biotic constants. One

can predict when the egg, larval, pupal and adult populations will change on the basis of the biotic constants when the temperature and humidity under which they are developing are known. The mathematical consideration of the growth of the population has been dealt with by Stanley (1932) in a recent paper. It will be sufficient at this point to call attention to the uniformity of the stages of population growth and the fact that populations, under the same conditions, have practically identical fluctuations as they approach equilibrium. (Fig. 1.) In his detailed analysis of the trend of the populations, Stanley was not satisfied with simple empirical formulae. He contended that the situation with regard to the population at any one time was the result of its previous history and that any damage that it might suffer was irreparable within finite time.

In the course of the study of populations under constant conditions, it was found that by varying temperature and humidity the rates at which the populations moved to their equilibrium values could be varied; and to a less extent the level which they finally attained could be influenced by these physical factors, as was pointed out by Holdaway (1932) in his study of the effect of moisture. After being satisfied with the results of experiments on the constancy of populations under constant conditions and having the results verified by workers in other institutions, as by Allee (1931) and Park (1932), the next step was to proceed on an experimental basis to offset the equilibrium of these populations. It was the plan to introduce a parasite into the system and see what effect this would have upon the equilibrium. But just before the plans for this experiment were completed, something went wrong with the cultures that had been in equilibrium. They broke down; at first in a very disorderly way. Their behavior was so disturbing that there seemed to be nothing to do but watch the disorder proceed. However, eventually they fell into a rhythmic fluctuation; and, most remarkable of all, two populations which had been handled in duplicate assumed the same synchronous rhythm as their levels sank lower and lower. (Fig. 2.) At last it was decided to kill all the individuals of both cultures and examine them carefully, whereupon it was found that they were infested with a sporozoan Protozoa belonging to the genus Adelina. This

parasite infests the larvae and kills them at about the time of pupation.

The synchronous rhythmic fluctuations were so striking and so much like those postulated by Volterra for the fluctuations of species that it was decided to sterilize all the equipment and start over with cultures set up at the equilibrium levels; and then to infest them with Adelina and watch the progress of the populations. Four cultures were set up: two at 27 degrees, and two at 32 degrees Centigrade. The growth of the parasite was inhibited at 32 degrees, and at times some of the beetles succeeded in pupating and emerging as adults. Since these cultures were set up with about 374 adults each, which were of random age, the adults of populations could be expected to gradually die out, inasmuch as they would not be replenished by new individuals. Since the life of an adult Tribolium is about a year, the oldest members of these populations should die almost at once and the youngest would all be dead in a year's time. It is interesting to note that during the 360 days during which these cultures were carried on at 27 degrees the adult population curve dropped off as a straight line. And at the end of this period of time these two populations were within ten individuals of the same number. Due to the cannibalistic habits of the larvae and adults, eggs are eaten when there are high populations of larvae to accidentally encounter them in the flour. The result is that when larvae are few, eggs are many. When the eggs hatch, the larvae proceed to the eating of eggs, with the result that the egg curves go down. The curves for larvae and eggs are then similar to those for predator and prey. As time goes on, the fluctuations of these two curves with their opposite tendencies become more and more marked, and the synchronism of the two duplicate populations is very striking. Here then is a case where physical factors were maintained constant; and the interaction of the biotic factors not only produced regular fluctuations, but in the two duplicate populations these fluctuations were strikingly similar in period and amplitude. They are not only like each other, but like the original populations which were accidentally infested.

It is unfortunate in this case that we did not have a method of recording the abundance of the protozoan parasite. Neverthe-

less, the fluctuating curves of eggs and larvae bear the relationship of prey and predator. They demonstrate periodic fluctuations of populations under physical conditions which are maintained as nearly constant as possible in a Carrier cabinet with a temperature and relative humidity control, and food changed at regular intervals. The experiment constitutes a demonstration of Volterra's first law of fluctuations; the law of the periodic cycle.

Inasmuch as the laws of fluctuations all assume that the coefficients of increase, or biotic potential, are constant, another series of experiments was set up to determine what effect a difference in the number of eggs laid or in the reproduction potentials of the insect might have upon the rates at which the populations increase and the level which they ultimately attain. The theory of biotic potential and environmental resistance rests upon the hypothesis that the rate of reproduction on the one hand, and the resistance of the environment on the other, determine the trend of populations.

It was found, as one might naturally expect, that in any population of female Tribolium there would be a normal distribution of egg-laying ability. Some females have a relatively high egg-laying rate and others a much lower egg-laying rate. Therefore, groups of females were selected, some of which had a high egg-laying rate, and others of which had a low egg-laying rate. These were set up in duplicate. The trends of these populations can be followed in Figure 2. The egg curves for populations 1 and 2 (those of the high egg-laying rates) rise more rapidly than those of populations 3 and 4; and maintain a much higher level during the first phase of population growth, as might be expected. If it were not for the cannibalistic habits of the larvae, these egg populations would have maintained these constant levels until the new adults began to lay. However, as the larval populations came up, the egg populations went down. As anticipated, the larval populations, in the case of those with a high egg-laying rate, rose to a level about equal to that which had been maintained by the eggs, and the same was true of the populations represented by the low egg-laying rate.

It was inevitable then that the numbers of pupae in the populations 1 and 2 would be higher than for 3 and 4. And, in turn, it

was inevitable that the number of adults in the first two populations should be greater than in the last two, as the populations entered the second phase of their growth. The first two populations agree very closely in all their behavior. In the early part of their history any difference that became evident in one stage was reflected by a difference in the succeeding stage. Culture No. 1 produced a few more eggs at first than Culture No. 2. Culture No. 2 later produced a few more eggs than Culture No. 1; and this in turn was followed by a larger number of larvae in Culture No. 2; and then by a larger number of pupae. At an age of 90 days there were about 10 per cent more adults in the second culture than in the first. But since the adults are carnivorous and eat their own eggs, Culture No. 1 soon had about a hundred more eggs than No. 2, and then more larvae; and this was soon followed by more pupae, and then more adults. When the F_1 daughter adults emerged and the populations entered their third phase of growth, the two populations were equal and from that time on remained practically identical.

Turning our attention now to the history of the two populations which were selected for low egg-laying rate, we find some interesting discrepancies. Through an unfortunate error in the early history of population No. 4, a portion of the record was omitted. From the level to which the larval populations arose, it may be assumed that the egg curve must have reached a level higher than that of Culture No. 3.

During the second phase of the population growth, we find the greatest difference between the adult populations of the cultures selected for high and low egg-laying rates. This is what one would expect, for these individuals are the direct result of the eggs laid by the original adults. Unless the daughters inherited their mothers' egg-laying propensities, we might expect that the differences between the populations would disappear. The most striking thing in the entire experiment is the fact that when the F_1 daughters began to lay, the egg curve of Culture No. 3 rose higher than that of any other culture in the experiment; while that of No. 4 was lower than any other. It must be kept in mind that these egg curves do not represent solely the rate of egg laying, but they are the net result of the laying and eating that is being

done in the population. Therefore, a culture with a small number of adults may have a large number of eggs present in it, and vice versa. Culture No. 4 with its small number of eggs soon outstripped all others in the population of larvae, and after 120 days it had an enormous advantage over the others, with a resultant high population of pupae. When the F_2 adults began to emerge the population curve for No. 4 mounted rapidly until it reached the level of Nos. 1 and 2. Thus, the advantage of the high egg-laying rate on the part of the grandmothers was entirely wiped out by the time the F_2 generation appeared on the scene. Culture No. 3, since the emergence of the F_1 daughters, held the record for highest number of eggs present in any population, yet it was unable to reach the population level of the other cultures. At the age of 120 days the adults' curve was mounting as rapidly as that of population No. 4. But, although it has had the high egg population, it has not been able to maintain a high larval population. It consequently found itself at 140 days with a low pupal population. Cultures 1, 2, and 4 reached the saturation point during the third phase of their growth, and from this point on the eggs will have little chance of escaping being eaten during the period required for hatching. In Culture No. 3, however, the chances of hatching are better, for there are fewer adults present. Consequently, it has been able to make slow but steady gains, and is at the present time at a level less than 10 per cent below that of the other three populations. This discrepancy of less than 10 per cent is negligible as compared with the data used by the observational biologists. In fact, the adult curves described for these four cultures from the beginning agree more closely with each other than the data used by many of our mathematically inclined contemporaries. But with the experimental technique one is permitted to examine into the smallest discrepancies and to seek their explanation. One must remember that the numbers which have been given as population values are exact counts of the entire populations and not estimates. They seem to indicate that, complicated though the problem may be, it is not beyond the possibility of attack.

To summarize, the Tribolium studies have thus far demonstrated that:

1. Populations will rise to a point of saturation which is independent of the size of the environment and of the initial population, so long as other environmental conditions remain constant. This is a substantiation of Volterra's "Law of the Conservation of the Averages."

2. Populations consisting of members, some of which feed upon the others, fluctuate periodically regardless of the fact that the physical conditions of the environment are constant. This is essentially a substantiation of Volterra's "Law of the Periodic Cycle."

3. If a population is started from individuals with a reproductive potential below that of the mean for their species, the immediate effect is to retard the rate of population growth, but the population will ultimately reach its normal saturation because the daughters of the next generation will tend to conform to the mean reproduction potential for their species. Any advantage or disadvantage which individual members of a population may possess will be lost in the next generation unless inherited.

As remote as these beakers of flour beetles may seem from the problems of pineapple and sugar cane fields, they may after all be no more remote from the practical things of life than the geneticist's cultures of Drosophila in milk bottles, which have made more fundamental contributions to the practical problems of breeding animals and plants than all the research on domesticated animals put together. Progress will admittedly be slow, but the results seem to be nature's own answer to the question of what factors influence population fluctuations.

BIBLIOGRAPHY

Allee, W. C. Animal Aggregations. Chicago: University of Chicago Press. 1931. 431 pages.

Bodenheimer, F. S. Über die Grundlagen einer allgemeinen Epidemiologie der Insektenkalamitäten. Zeitschr. f. angen. Entom. 1930; 16:433-450.

Eidmann, H. Zur Kenntnis der Periodizität der Insektenepidemien. Zeitschr. f. angen. Entom. 1931; 18:537-567.

Fourier, J. B. J. The Analytical Theory of Heat. Translated with notes by Alexander Freeman. Cambridge University Press. 1878; 466 pages.

Gause, G. F. Ecology of Populations. Quarterly Review of Biology. 1932; VII: 27-46.

Holdaway, F. G. An Experimental Study of the Growth of Populations of the "Flour Beetle" *Tribolium confusum* Duval, as Affected by Atmospheric Moisture. Ecological Monograph. 1932; 2:261-304.

Martini, E. Zur Terminologie in der Lehre vom Massenwechsel der Organismen. Zeitschr. f. angen. Entom. 1931; 18:440-459.

Muir, F. Presidential Address. Proc. Hawaii. Ent. Soc. 1914; 3:28-42.

Park, Thomas. Studies in population physiology: the relation of numbers to initial population growth in the flour beetle *Tribolium confusum* Duval. Ecology 1932; 13:172-181.

Stanley, John. A Mathematical Theory of the Growth of Populations of the Flour Beetle, *Tribolium confusum* Duv. Canadian Journal of Research, 1932; 6:632-671.

Sweetman, M. D., and Leroy S. Palmer. Insects as Test Animals in Vitamin Research. Jour. Biol. Chem. 1928; 77:33-52.

Volterra, Vito. Variations and fluctuations of the number of individuals in animal species living together. In "Animal Ecology," by R. N. Chapman. McGraw-Hill. 1931. Pages 409-448.

Zwölfer, W. Zur Lehre von den Bevölkerungsbewegungen der Insekten. Zeitschr. f. angen. Entom. 1932; XIX:1-21.

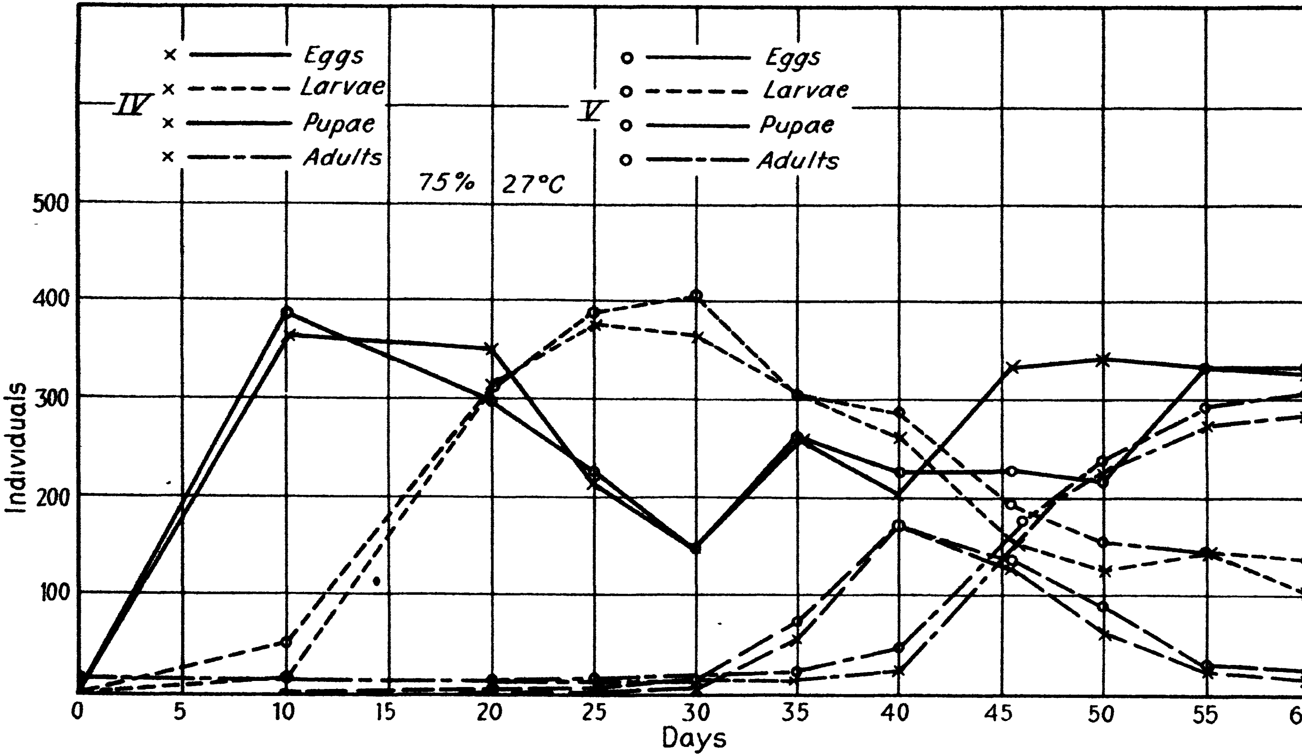

Fig. 1. Population trend of *Tribolium confusum* Duval at 27 degrees C. and 75 per cent of relative humidity. Two populations, IV and V compared.

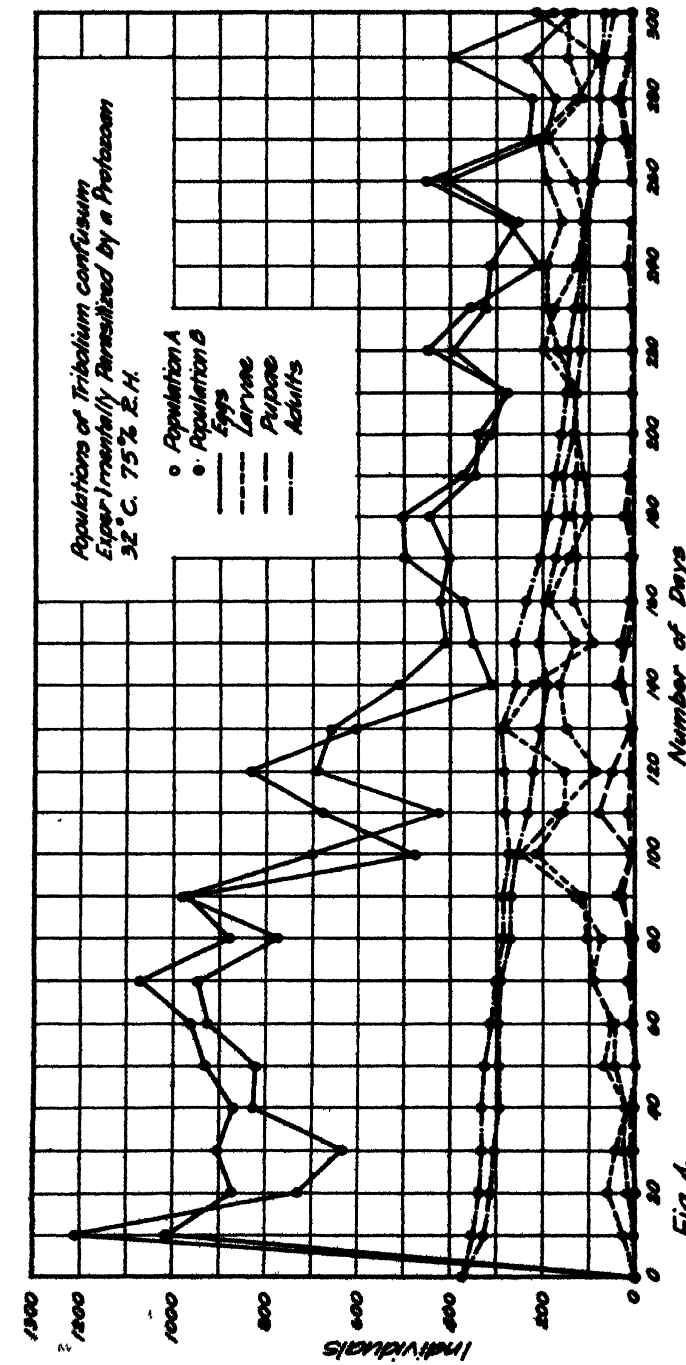

Fig. 4

Fig. 4. Populations of *Tribolium confusum* experimentally infested with *Adelina* at 32 degrees C. and 75 per cent of relative humidity. Duplicate populations A and B compared.

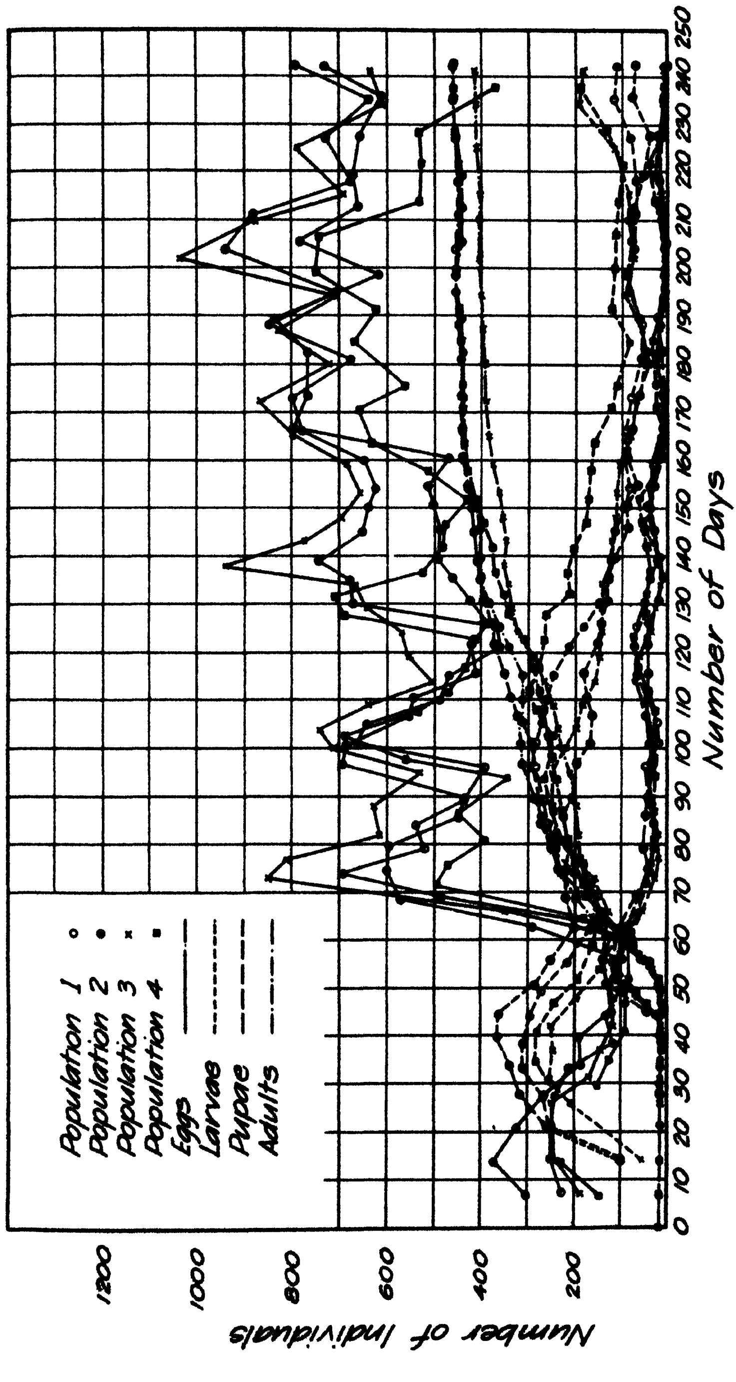

Fig. 5. A comparison of populations of *Tribolium confusum* originally selected for high and low egg laying rates. Populations 1 and 2 were started with females having a high egg-laying rate. Populations 3 and 4 were started with females having a low egg-laying rate.

New Hawaiian Lepidoptera

BY O. H. SWEZEY

(Presented at the meeting of December 1, 1932)

While making studies on the insect faunas of the native forest trees of the high plateau of Kauai in the vicinity of the Kokee summer camps in June and July, 1932, several new moths were discovered, which are herein described. These were all reared from larvae found in their respective natural habitats. This is an indication of the possibilities of the discovery of more new species when there is further opportunity for research in that region. A new moth from the Waianae Mts., Oahu, and some notes on a few other Hawaiian moths are herewith included. Types of the new species are deposited in the collection of the Hawaiian Entomological Society.

PHYCITIDAE

Homoeosoma bidensana n. sp.

Male, 17 mm., female, 18-27 mm. Whole insect nearly uniformly brownish fuscous. Forewing having two oblique bars of white scales, one arising at about 1/5 of costa and extending obliquely to about middle of dorsum, the other arising at about 4/5 of costa and extending obliquely across wing parallel to termen. Sometimes a suffusion of white scales on part of the middle of wing between the white bars, and also near termen. Veins 4 and 5 of forewings coincident as in *humeralis*. Very distinct from other Hawaiian species of the genus.

Described from 1 male and 3 females reared from larvae boring in the stems of *Bidens cosmoides;* pupation takes place within the stem.

Hab.—KAUAI, Kumuwela, June 25 and July 15, 1932; Nualolo, June 26, 1932 (Swezey).

PYRAUSTIDAE

Phlyctaenia violae n. sp.

Male, 20 mm. Antennae brownish fuscous, with some white scales on basal joint. Palpi with brownish fuscous and white scales mixed. Head white, with a fuscous median spot on frons and a few fuscous scales on

occiput. Thorax brownish fuscous on disk, patagia and apex ochreous. Forewings white on disk; basal fourth with a slight suffusion of fuscous; a heavy fuscous bar obliquely from about 1/5 of costa extending 2/3 towards dorsum, widened distally, from distal end two fuscous sinuate lines wide apart extend to dorsum; costa fuscous except for two white spots enclosing a fuscous spot at 2/3, from this spot a sharply sinuous fuscous line extends to vein 2; 8-shaped discal spot outlined with fuscous, heavier on costal side; a series of fuscous dots on termen, preceded by a slight fuscous suffusion which is more dense near apex; cilia fuscous and white mixed, entirely fuscous at base. Hindwings nearly uniformly light fuscous, with a darker discal dot and an indistinctly indicated postmedian fuscous line; cilia white, fuscous at base. Abdomen light fuscous with indications of white rings on apical margins of segments. Legs fuscous, tibiae white at apex and tarsi white spotted.

Reared from a caterpillar on leaves of *Viola* sp. (a native species of violet). Three caterpillars were found, but two proved to be parasitized. Of the latter, one died before the parasite larva obtained its growth, and from the other a parasite larva issued, spun its cocoon and eventually matured as *Cremastus hymeniae* Viereck. This adds another to the long list of hosts of *C. hymeniae*.

The full-grown *P. violae* larva was 20 mm.; light green, with white longitudinal dorsal fat bodies showing through. Head plate testaceous with slight browning on the sides, eyes black. A black longitudinal bar on each lateral margin of cervical plate. The larva spun up between leaves, and the pupa was formed February 19, from which the adult moth issued March 3, 26 days from the date of capture, February 5.

Hab.—OAHU, Puu Kanehoa, Waianae Mts., Feb. 5, 1933 (Swezey).

Phlyctaenia platyleuca Meyr.

One moth was reared from a larva on leaves of *Urera sandwicensis,* Kamokuiki Valley, Waianae Mts., April 2, 1933. Larvae were quite numerous on the trees, the latter being quite numerous and larger than I had observed elsewhere. A species of Sierola was present. A caterpillar was found on which 3 Sierola larvae had just finished eating. They spun cocoons, but died without maturing. Three *Casinaria infesta* (Cress.) larvae issued from as many caterpillars and produced cocoons, from which the adults issued April 20. The only previous rearing of this species of Phlyctaenia was from *Touchardia latifolia* on Mt. Tantalus, 1908 and 1909. This is a closely related tree.

TORTRICIDAE

Capua pterotropiana n. sp.

Male, 16-17 mm. Antennae cinereous, strongly banded with brownish fuscous above, a few of the basal segments entirely brownish above; scape white with a few scattered brownish scales above or entirely brownish above. Palpi white, first and second joints brownish fuscous externally except at apex of second joint, terminal joint whitish or sometimes with scattered fuscous scales. Head white, with a few pale brownish scales posteriorly. Thorax brownish, with mixture of yellow, green and fuscous scales; patagia brownish tipped with white. Forewings pale greenish white with patches of fuscous brown: a patch occupying about basal fourth of wing and containing a few greenish scales at base dorsally; a large irregular triangle with its base occupying costa from about 1/3 to 3/4, its apex on fold with a projection towards tornus, some greenish scales near costa in middle of base; a row of marginal spots on dorsum and termen and apical part of costa, some of these spots larger, particularly one about middle of dorsum and one about middle of termen; a pair of white spots on costa at 1/3, another pair at 2/3 and another pair towards apex: terminal cilia tawny greyish. Costal fold extends to the beginning of the base of large triangle, white at tip and a larger white patch a little before tip. Hindwings and cilia tawny greyish. Abdomen tawny greyish, anal tufts ochreous. Fore and middle legs fuscous with pale bars: hind legs tawny greyish.

Female, 22-24 mm. Similar to male but larger: disc of thorax mostly pale greenish; the basal brown patch of forewing is divided longitudinally by a greenish patch; an oval brown spot in midde before termen.

Described from 2 males and 6 females reared from larvae in terminal buds of *Pterotropia kauaiensis*. Apparently allied to *Capua* (?) *glaucoviridana* Walsm., which was described from a single female from Kaholuamano, Kauai, but larger than it in size and the brownish patches are more distinct and larger in size.

Hab.—KAUAI, Halemanu, June 22, 1932 (Swezey).

Capua oheoheana n. sp.

Male, 9-10 mm. Antennae cinereous, banded with dark fuscous above. Palpi cinereous, fuscous externally, terminal joint short almost entirely fuscous. Head and thorax brownish fuscous. Forewings variegated, mostly brownish fuscous; a pair of whitish costal spots at about 1/3 and another pair at about 2/3, from the first pair of spots a band with somewhat of whitish suffusion crosses the wing, the basal portion before this band is somewhat suffused with orange scales; a few orange scales scattered throughout the wing, a scattering of silvery white scales throughout; cilia fuscous; no costal fold. Hindwings and cilia dark fuscous. Abdomen fuscous, anal tufts pale. Legs mostly cinereous, banded with fuscous.

Female, 11 mm. Similar to male, except that the whitish band from 1/3 of costa is more distinct and wider, twice as wide on dorsum as on costa, having a few ochreous scales; another similar band from 2/3 of costa obliquely to tornus, with a projection to near apex of costa, thus making a

Y-shaped area or spot. Distinctly different from other Hawaiian species of Capua.

Described from 4 males and 1 female, collected and reared from *Pterotropia kauaiensis*, larvae and pupae found in dead twigs. The name is from "ohe ohe," the native name of the tree. As treated in the Fauna Hawaiiensis, this species would fall in the genus Epagoge on account of the absence of costal fold in the male. However, Meyrick, in the Revised Handbook of British Lepidoptera (1928) in the description of Capua, says: "Forewing of male with or without costal fold," and places in the genus Capua the species which were under Epagoge in his Handbook of British Lepidoptera, of 1895. Hence, it might be inferred that Epagoge is to be considered as synonymous with Capua.

Hab.—KAUAI, Halemanu, June 29, 1932 (Swezey).

TORTRICIDAE

Eulia lysimachiae n. sp.

Male, 17 mm. Head and thorax not in perfect condition, but apparently nearly uniformly tawny greyish. Forewings tawny greyish, with faint fuscous strigations; at 1/5 of costa a larger or more conspicuous one extends about 1/4 across the wing; at 1/3 of costa a broad fuscous band extends obliquely to the fold; on costa beyond this, two large fuscous spots followed by a few smaller ones before the apex; dorsally from the two large costal spots are two other fuscous spots, one oval, the other larger and irregular in outline, they tend to be connected; terminal area with brownish suffusion, widest a little beyond apex and narrowing to termen; a narrow costal fold on basal fourth of costa. Cilia of termen ochraceous, with some fuscous scales towards apex. Hindwings tawny cinereous with numerous small faint fuscous spots and strigulae; cilia cinereous. Abdomen tawny greyish. Fore and middle legs fuscous; hind legs paler.

Described from one male reared from larva on leaves of *Lysimachia hillebrandi* var. *venosa*.

Hab.—KAUAI, Kalalau Trail, about 3800 ft. elevation, June 23, 1932 (Swezey).

EUCOSMIDAE

Crocidosema marcidellum (Walsm.)

One specimen of this moth was reared from a larva found boring in a petiole of leaf of *Abortopetalum sandwicense* in Makaha Valley, 1850 ft. elevation, March 30, 1933, by Mr. Glenn Russ. Five specimens were reared from the same plant in Kamokuiki

Valley, about 2000 ft. elevation, Waianae Mts., April 13, 1933 (Swezey and Williams). The petioles in which larvae are boring become considerably swollen. The only previous rearing of this moth was from fruits of *Hibiscus arnottianus* on Mt. Tantalus, 1914 and 1924 (Swezey).

Diplosaridae

Bubaloceras pritchardiae n. sp.

Male, 21 mm. Antennae brownish ochreous, more intensely so on the widened curved basal joint. Palpi whitish ochreous. Head and thorax brownish ochreous, head whitish ochreous in front, patagia with whitish margins, collar whitish, some whitish scales at apex. Forewings brownish ochreous, with a few scattered fuscous scales, some of them arranged in obscure dots; one elongate about middle of cell, two on fold, and one at discocellulars; cilia brownish ochreous, paler towards dorsum. Hindwings and cilia cinereous, apical cilia brownish ochreous. Abdomen cinereous, anal tufts concolorous. Legs cinereous, somewhat infuscated dorsally.

Female, 22 mm. Similar to male except for sexual characters.

Described from one male and three females (2 cripples) reared from larvae feeding in the abundant fulvous cottony tomentum, with which the spathe and other parts of inflorescence of *Pritchardia eriophora* is clothed. The moths are about the color of this cottony substance. Distinct from the only other known species of the genus, which is nearly white, and occurs on Molokai. The large curved and widened basal joint of the antenna with its hair pecten determines the genus.

Hab.—KAUAI, Kumuwela, July 1, 1932 (Swezey).

Gracilariadae

Parectopa ureraella (Swezey)

Mines of this moth were found abundant in leaves of *Urera kaalae* near Puu Kaua, Waianae Mts., Nov. 6, 1932. A few specimens were reared. They vary slightly from those that have been reared previously from *Urera sandwicensis* on Mt. Tantalus.

Plutellidae

Acrolepia aiea n. sp.

Male, 8 mm. (undersized from lack of food). Antennae whitish, strongly banded with black. Palpi whitish ochreous, with wide fuscous band on median segment externally and two fuscous bands on terminal segment

externally. Head whitish ochreous, with a few fuscous scales at base of antennae. Thorax ochreous and fuscous mixed. Forewings ochreous, fuscous and white, the fuscous scales with a tendency to be arranged in strigulae and costal spots, more generally distributed on basal fourth, and on terminal area; the white is chiefly in a wide band directly across wing from about 1/3 of costa, which is nearly divided by an incomplete line of fuscous scales, there are white costal spots, and a few white scales scattered throughout; terminal cilia fuscous, with a white spot near middle of termen. Hindwings and cilia cinereous fuscous, fading to nearly white on basal half. Abdomen cinereous, anal tufts concolorous. Legs cinereous, strongly barred with fuscous.

Described from a single male reared from mine in leaf of *Nothocestrum latifolium*. Named with the native name of the host tree. Allied to *Acrolepia nothocestri* Busck on Oahu, but the latter lacks the white band on the forewing, though it has a large white spot on dorsum in the position of dorsal end of the white band of forewing of *A. aiea*.

Hab.—KAUAI, Kumuwela, July 15, 1932 (Swezey).

Notes on Tromatobia rufopectus (Cress.), a recent Immigrant in Hawaii (Hymenoptera)

BY O. H. SWEZEY

(Presented at the meeting of December 1, 1932)

This parasite in the egg cocoons of *Argiope avara* was first discovered in Hawaii by Mr. J. S. Rosa, at the Kailua substation of the Hawaiian Sugar Planters' Association, June 14, 1932, where they were issuing from an egg cocoon. The next collection of the parasite was by the writer at Kumuwela, Kauai, June 25, 1932, when a spider egg cocoon was found on a Dianella leaf, which contained 10 parasite pupae, from which the adults matured June 30. Later collections were as follows: Sept. 11, Gunsight Pass, Waianae Mts., one specimen collected; Sept. 27, Makua Valley, Oahu, an egg cocoon of *Argiope avara* collected, from which 11 parasites issued on Oct. 10; Oct. 9, an Argiópe cocoon collected by Dr. F. X. Williams at Pauoa Flats, contained 8 eggs of the parasite; Nov. 7, one egg cocoon with 8 to 10 parasite eggs, collected in an abandoned pineapple field at Kunia, Oahu; Nov. 16, 8 Argiope egg cocoons were found at Kalauoa, Oahu, near together among twigs of an *Acacia confusa* tree, from all of which parasites had issued. In November, also, Dr. Williams collected spider cocoons (Pagiopalus) from cane leaves at Honokaa, Hawaii, from which three of the parasites issued early in December. Nearly every cocoon had had parasites, only one parasite in each of 6 spider egg cocoons.

Thus this parasite is known to occur on Oahu, Kauai and Hawaii, and seems to be quite effective in reducing its chief host, for *Argiope avara* is not nearly as common at present as formerly. At least three species of spiders are known as hosts. Besides Argiope and Pagiopalus, mentioned above, the egg cocoon from which parasites were reared on Kauai was of a different species, but its identity not known. In California, from whence it undoubtedly came, Tromatobia larvae are said to feed on the eggs of *Argiope argentata* and other spiders of the family Epeiridae.

In such large egg cocoons as those of *Argiope avara*, not all of the eggs are eaten by the parasite larvae. In one instance, 360 spiders hatched from eggs left uneaten by 11 parasite larvae in a single cocoon. Counts were made of the eggs in a few of these cocoons, giving 467, 750, 948, respectively. Eight to eleven parasite eggs have been found in single egg cocoons. The eggs are deposited in the loose silk of the inner part of the cocoon, near together but not in contact, and not in contact with the spider eggs. The egg is white, cylindrical, rounded at one end, pointed at the other, 1 mm. long. On hatching the larvae pass to the interior of the mass of eggs, feeding for about 3 or 4 days, when they become 6-7 mm. long, plump and yellow. Cocoons are spun, more or less attached, and the adults mature and issue in about 8 to 10 days, or 11 to 14 days from the hatching of the eggs.

In several instances larvae were isolated in separate vials and given 50 eggs apiece to determine how many eggs are required for their growth. The number eaten was a little less than 50, a few being left—42 to 45 were eaten, respectively. Allowing for 50 eggs per parasite larva, the number of eggs consumed in an Argiope egg cocoon with the maximum number of parasites (11) would be 550. As the number of eggs per cocoon is often much in excess of this, there should be a large number of eggs left for hatching. It would seem that the parasite would not have much effect in reducing this particular one of its hosts, and yet it is already noticeably less prevalent than formerly.

New Dolichopodidae from the Hawaiian Islands (Diptera)

BY M. C. VAN DUZEE, BUFFALO, N. Y.

PREFACE

BY FRANCIS X. WILLIAMS

Little is known of the distribution and habits of Hawaiian dolichopodid flies. The family is very well represented here, and more collecting will undoubtedly bring to light many new species in addition to the 32 described below by Mr. M. C. Van Duzee. Dolichopodidae are common in damp forests to very considerable altitudes. Quite a number of forms occur in the cultivated areas where there is sufficient shade and moisture to suit their needs. Several species are found about soil in greenhouses. A few may be immigrant insects, but the great majority are peculiar to the Hawaiian Islands, and, as far as collections show, each species is usually restricted to one island of the group.

The few condensed notes that follow on the habits and early stages of some of these dainty flies have been gathered during several years of intermittent study of the water-loving insects of Hawaii, and upon which the writer soon hopes to publish.

The common *Dolichopus exsul* Aldrich is found in many damp situations; it occurs about leaky faucets out of doors, along ditches, water courses, etc. It seldom alights upon clear water, but makes brisk short flights low over the water and ground and diligently explores the margins of pools and wet rocks. It is carnivorous and has been observed feeding on a dead winged form of our mountain termite (*Neotermes connexus* Snyder). A good-sized dolichopodid larva occasionally found about filamentous green algae on the edge of a waterfall back of Honolulu, or in a floating mat of algae in a little pool there, may be this species.

The extensive genus Campsicnemus, consisting mainly of not very metallic looking to even somber little flies, is of considerable interest here since many of its species spend much of their existence as adults upon the surface of water. A large percentage of these insects ride the waters of tiny cañon or gully pools, or of

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bogs, seeking soft dead insects and venturing at times to pursue—vainly so far as I have observed—the larger collembolous insects that are occasionally seen nimbly leaping on the water. Such Campsicnemus flies, commonest of which on Oahu appears to be the little *C. gloriosus* Van Duzee, are active runners upon the water, quickly turning about and often progressing with the help of their wings. Since many of the poollets patronized by these flies disappear at times through insufficient rains, these insects must get along well enough on the forest floor. Several kinds of Campsicnemus are found mile high on more permanent waters on the slopes of Mauna Kea, Hawaii. Here we sometimes found them on boggy puddles in the forest or else skating gracefully on poollets of clear water along the little Nauhi Gulch stream.

However, by far the best performers upon the surface of water observed among the Dolichopodidae, or among any other insects here, are two species (more will probably be found) of rather large sooty-looking Campsicnemus, *C. nigricollis* and *C. miritibialis,* both described here by Mr. M. C. Van Duzee. The former fly occurs in the uplands of Kauai (Kokee), the latter disports itself on the more permanent streams back of Honolulu. These insects employ the middle pair of legs and their wings in propelling themselves in their sometimes almost invisibly swift graceful gyrations on the surface of the water. They travel over a more or less regular "beat" or restricted area of water and, when two flies meet, there is usually an extremely rapid scuffle for a moment. Such a beat is usually where there is a gentle current, being frequently near the head of a little pool or below a small rapids, and the flies maintain their place—when not dashing about—by regular strokes of the middle pair of legs and flicking of the wings. Patrolling thus with speed and alertness, they are able to capture the large and active collembolan, *Salina maculata* Folsom (Proc. Haw. Ent. Soc., VIII, No. 1, p. 71, figs. 105-110, 1932) that is abundant about the haunts of *C. miritibialis* and is occasionally seen on the water, and that at least at times must form one of the chief foods of this fly.

Campsicnemus flies will sometimes lay their smooth, long-oval, pale-brownish eggs on the wet cotton stoppers of their vial prison. I found the young difficult to rear. By enclosing some adult *C. gloriosus* in jars containing very wet bog mud, moss and plant

stems, I secured over 5 weeks later a single male fly of this species.

The relatively large pale gray *Hydrophorus pacificus*, here described by Mr. Van Duzee, is an accomplished skater of lowland maritime marshes and also runs over the muddy shores. The adult fly has been observed pulling out of shallow water and devouring blood worms (the larvae of our *Chironomus hawaiiensis* Grimshaw). It lays a number of dark polished long-oval eggs; its larva, also carnivorous in its muddy environment, pupates in a cocoon that in due time yields the long-legged adult fly.

F. X. W.

The present paper was prepared from a collection of more than 220 specimens, nearly all of which were taken by Dr. F. X. Williams and Mr. O. H. Swezey, largely by the former. Thirty-two species are described as new; only two of the species previously described from the Islands were found among them, one being *Dolichopus exsul* Aldrich, described by Dr. Aldrich in 1922, Proc. U. S. National Museum, Vol. 61, Article 25, p. 15. This species has been taken on the islands of Oahu and Hawaii, and so far is one of the very few species of the family known to have been taken on more than one of the Islands; the known species of Dolichopodidae have been taken on only three of the Islands. Twenty-five species have been taken on Oahu, 10 on Hawaii, and 2 on Maui.

Mr. Percy H. Grimshaw in the Fauna Hawaiiensis, Vol. III, Part 1, published December 30th, 1901, recognized 9 species of the family, all but one he described as new. That one he determined as *Psilopus patellifer* Thomson, but as it differs considerably from Thomson's description of that species I am here describing it as *Chrysosoma fraternum* new species.

In Fauna Hawaiiensis, Vol. III, Part II, published in December, 1902, Mr. Grimshaw described two more species of dolichopods. For one of these species he erects the new genus Emperoptera, describing the species as *E. mirabilis*. The wings of this form are represented by dark-brown appendages, which in his drawing look as if they might be the costal vein only. He describes this genus and species from nine specimens taken on the island of Oahu.

Liancalus metallicus Grimshaw was described from one male and two females from Hawaii. His other species are all included in the tables of species in this paper. These are: one Chrysosoma, three Chrysotus and four Campsicnemus.

The material sent me by Dr. Williams brings the known species of Dolichopodidae up to 46, which are placed in the following eleven genera: Chrysosoma, two species; Campsicnemus, 27 species; Chrysotus, five; Dolichopus, one; Emperoptera, one; Hydrophorus, one; Liancalus, one; Medetera, three; Sweziella, one; Syntormon, one, and Eurynogaster, three. Two of these genera are new: Eurynogaster and Sweziella. All holotypes and allotypes are in the collection of the Hawaiian Entomological Society in Honolulu, except that of *Chrysosoma fraternum* new species. I wish to thank Dr. Williams very much for sending this material to me for study. The collection proved of special interest, especially the remarkable number of forms of the genus Campsicnemus, many of which are water skaters.

I also want to thank Dr. Aldrich for loaning me two pairs of Chrysosoma from the National Museum Collection and sending me a copy of Thomson's description of *Psilopus patellifer*, making it possible to describe *Chrysosoma fraternum* as new.

Chrysosoma fraternum new species.

Male: Length 5 mm.; of wing 6 mm. Face wide, shining green, portion below the suture about as long as wide, cut off somewhat straight below with a small point in the middle and slightly emarginate on each side of this point; lower half of face with rather thick white pollen; palpi and proboscis yellowish brown, former with black hair, latter with an acutely pointed triangle in the center; front shining green; ocellar-tubercule projecting, almost short cylindrical; antennae (Fig. 1) black, third joint triangular with a bare arista, which is as long as the abdomen and has a small lamella at tip (Fig. 2) which is a very little whitish at apex and has a very short, black, pubescent projection in the center of the tip; the black orbital cilia reach down to about the middle of the eyes; beard white, moderately long, but not very abundant.

Thorax and abdomen shining green with bronze reflections, latter with narrow black incisures and black hair, lower edge of sides and the venter with rather long white hair; pleura largely black, three pairs of large acrostichals; two pairs of large dorsocentrals; scutellum semicircular, green, bluish in middle, with one pair of slender bristles; hypopygium (Fig. 3) black, with its appendages mostly reddish yellow, but partly reddish brown and blackish, lamellae-like organs extending downward, one pair of curved organs extending forward from upper corners and a longer pair (Fig. 4) extending forward from the middle of the lamella; from base of upper pair

is a small slender projection with two long fine hairs, and from the base of the hypopygium is a thick central organ.

All coxae and trochanters black; front coxae with long white hair and one or two black bristles near tip; all femora green with long white hair below, which are about one and one-third times as long as width of femora; anterior pair also have two long blackish bristles near base, which are about three and a half times as long as width of femora; all tibiae yellow, front and middle ones narrowly black at tip, posterior pair more widely black at tip and with a blackish, slightly swollen ring near basal fourth; fore tibiae above with one bristle of moderate size beyond the middle and two about half as large between that and base of tibia; middle tibiae with one bristle at the middle above and a larger one near base; hind tibiae without bristles of such size; all tarsi black, plain; length of front tibiae as 87, middle as 147, and hind as 173; joints of front tarsi as 70-22-14-8-8; of middle pair as 108-35-23-12-9; of posterior pair as 90-38-23-12-8. Calypteres yellow with black tip and white cilia; halteres with brown knob.

Wings grayish hyaline; costa with very short, recumbent hairs; second vein nearly straight, only gently bent back a little at tip, running close to the costa from tip of first joint to its tip; third vein considerably and evenly bent backward from a little beyond the forking of fourth vein to its tip; fork of fourth vein at a right angle with fourth, but broadly rounded almost from its start to the tip, becoming less arched on apical half or more; cross-vein oblique, sinuous; last section of fifth vein straight as far as it reaches, which is about half way to wing margin, but continued as a fold in wing membrane to a small notch in hind margin of wing, but not in a line with the first half of the last section of the vein; length of fifth vein from cross-vein to the notch on hind margin of wing as 25, of cross-vein as 49; last section of fourth vein from cross-vein to fork as 50, from fork to wing margin as 26, but the fourth vein ends a little beyond the fork.

Female: Antennae about as in the male, except that the arista is a little shorter and very slender towards its tip; all femora, tibiae and most of front and middle tarsi yellow, narrow tips of hind tibiae and their tarsi black; front femora with two very long black bristles below on basal third; front tibiae with three long slender bristles on lower posterior surface and four stouter ones above, those below four times and longest one above three times as long as width of tibiae; front tarsi with a large stout bristle above at apical third of first joint; middle tibiae with three long bristles on anterior surface, one near base on lower posterior edge, two on middle third of upper anterior edge, two large ones on upper posterior edge of basal half, and a small one near tip on posterior surface; posterior tibiae without bristles of much size; wings about as in the male, except that the cross-vein is nearly straight. Length of front tibiae of female as 84, middle as 115, and of hind as 110. Joints of front tarsi as 61-19-11-8-8; of middle as 76-22-18-8-9, and of posterior as 30-28-18-10-8. Halteres yellow, knobs more orange colored with tip brown.

Holotype, male, and allotype, female, taken by A. Busck, September, 1915, at Kona, Hawaii. Holotype and allotype in the U. S. National Museum.

There is no doubt that this is what P. H. Grimshaw determined as *Psilopus patellifer* Thomson. If we accepted Dr. Becker's synonomy of *patelliferum* as Grimshaw's species, it has been taken in Java, Sumatra and Borneo; the type location was the small island of Guam. Becker redescribes the species from specimens from Formosa, and they certainly were not the same species as Thomson had or that we have from Hawaii, and the Hawaiian species is not the same as *patellifer* Thomson, so we have three species very much alike; also Grimshaw campares it to *globifer* Wied., and Becker to *compressum* Becker. The following table will help to separate these forms and also *leucopogon* Wied., which also has a brown ring near base of hind tibiae, but the arista has no lamella at tip.

Table of Hawaiian Chrysosoma, together with several species related to *patellifer* Thomson, to which one Hawaiian species was referred.

1. Antennae, coxae, femora, and tibiae wholly pale yellow; arista as long as abdomen, without a lamella at tip; hypopygial lamellae a pair of long, slender, yellow filaments (Oahu) (Fig. 5) *pallidicornis* Grimshaw

   Antennae, femora, and most or all of coxae black or green; hypopygial appendages not at all filiform........................2

2. Front coxae yellow; arista with an apical lamella, which is black on basal, white on apical half, apical half deeply incised, fringe-like (Formosa)........................*patelliferum* Becker (not Thomson)

   All coxae wholly black; lamella at tip of arista, if any, not at all incised....3

3. Arista as long as the abdomen, without a lamella at tip; middle tibiae with a blackish ring near tip; hind tibiae with a blackish, swollen ring near base (India; Formosa)........................*leucopogon* Wiedemann

   Arista as long as abdomen, with a lamelliform tip; middle tibiae without a blackish ring near tip........................4

4. Lamella at tip of arista at least with apical half white........................5

   Lamella at tip of arista wholly black or with extreme tip white........................6

5. Arista with its lamella wholly white or nearly so; scutellum with two pairs of large marginal bristles; front femora with two large black bristles at base below; front tibiae with three large bristles below (Guam Island)........................*patellifer* Thomson

   Lamella at tip of arista with basal half black, apical half white; nearly oval, but base and tip a little pointed (China)........*globifer* Wiedemann

6. Hypopygium with outer, outstanding appendages simple; hind tibiae without a black tip; lamella at tip of arista wholly black; middle tibiae with two bristles below (Bengal, India)........................*compressum* Becker

   Hypopygium with outer outstanding appendages forked at tip; hind tibiae with a rather narrow black tip; arista with its lamella white at extreme tip; front and middle tibiae without bristles below (Hawaiian Islands)........................*fraternum* new species

Chrysotus vulgaris new species.

Male: Length 1.5 mm. Face wide, only a little narrowed below, dull black; palpi black, about as long as width of face, with whitish pollen and black hairs; front violet-blue; antennae blackish brown, third joint rounded, scarcely as long as wide; arista brown, apical; lower orbital cilia whitish.

Dorsum of thorax shining green, posterior part with bright coppery reflections; pleura black with slight blue reflections. Abdomen black with very slight blue reflections, black bristles and yellowish hair; hypopygium concealed.

All coxae almost wholly yellow, anterior pair with a few delicate yellow hairs, posterior pair without a bristle on outer surface; all femora, tibiae and tarsi pale yellow; fifth joint of all tarsi darkened, flattened and widened; front femora with a row of slender, black hairs on lower posterior surface; middle tibiae with a bristle above at basal fourth; middle and hind tibiae with bristles at tip; middle tarsi (Fig. 6) with the hairs below on first two joints a little more erect than those above; hind tarsi (Fig. 7) with the hairs below entirely erect on first two joints; length of fore tibiae as 33, of middle as 41 and of posterior pair as 49; joints of front tarsi as 15-6-5-4-4, of middle pair as 21-10-6-4-4, and of posterior pair as 10-12-6-4-5. Calypteres brown with yellowish cilia; halteres pale yellow.

Wings grayish, rather broad; third and fourth veins nearly straight, a little farther apart at tips than at the cross-vein, fourth ending in the apex of the wing; cross-vein near the middle of the wing; last section of fifth vein nearly straight; fifth vein from root of wing to cross-vein as 37, cross-vein as 8; anal angle of wing rounded, but rather prominent.

Described from one male, taken by F. X. Williams, on sugar cane, January 16, 1930, at Waialua, Oahu.

Chrysotus pallidipalpus new species.

Male: Length 1.2 mm. Face very narrow, black, eyes touching or nearly so in the middle of the face; palpi (Fig. 11) about one and three fourths times as long as the face, with white pollen and hairs; front blue-black, more violet in the middle; antennae (Fig. 10) wholly yellow, third joint rounded with long pubescence, arista brown with short pubescence; lower orbital cilia appear to be white (can scarcely be seen in the male, but white in the female).

Dorsum of thorax green, not very shining, its bristles black. Abdomen blue-black with yellowish hairs, these hairs appear more black in certain lights; hypopygium rounded, forming a rounded tip to the abdomen and more brown than blue-black, its lamella small, yellow, triangular, projecting below, fringed with moderately long hairs; central organ long, slender, inserted at lower posterior surface of hypopygium, curved under the abdomen.

Coxae, femora, tibiae and tarsi yellow; fore coxae with white hair; midle coxae blackish on basal half and tarsi a little darker toward their tips, middle pair with last three joints brown; fore femora with small hairs above and on lower part of posterior surface, where they are a little longer, below on basal three-fourths they have a few short delicate yellow hairs; hind femora with several moderately long black hairs below, one pair near tip more bristle-like; all tibiae without bristles of noticeable size, but pos-

terior pair with a row of bristle-like hairs on lower posterior edge extending their whole length, and as long as diameter of tibia; these are continued on their basitarsi, but are much shorter, all joints of hind tarsi have short, rather erect hairs below and longer recumbent hairs above; length of front tibiae as 30, of posterior as 41; joints of front tarsi as 15-6-5-5-4, of middle pair 18-8-6-3-3, of posterior pair as 9-11-7-4-3. Calypteres yellowish with black cilia, which appear pale in certain lights; halteres pale yellow.

Wings nearly hyaline, veins thin; third and fourth veins nearly straight and parallel beyond the cross-vein, fourth ending in the apex of the wing; last section of fifth vein about three times as long as cross-vein; anal angle of wing rounded, but somewhat prominent.

Female: Face black, the narrow part below grayish pollinose, face wide above, narrow and elongated below; palpi rather large, black; antennae about as in the male; posterior tibiae without the row of long hairs; middle tibiae as 40; joints of fore tarsi as 16-7-5-3-3, of middle as 19-10-6-3-3, posterior pair as 11-11-6-3-4; thorax shining green with coppery reflections; abdomen black with pale hairs.

Described from three pairs and two females, taken by O. H. Swezey, January 21, 1930, at Honolulu, Oahu, T. H., and one female, taken by F. X. Williams, on sugar cane, January 16, 1930, at Waialua, Oahu.

Table of the males of the species of Chrysotus known to be found in Hawaiian Islands.

1. Femora largely black, brown or green; antennae black 2
   Femora yellow; antennae sometimes black and sometimes yellow 3
2. Face silvery white, narrow; middle femora with two preapical bristles, one above and one below, also seven stout bristles below, the second from base the longest, those beyond about half as large (Figs. 8 and 9) (Maui) .... *spiniger* Grimshaw
   Face rather wide, shining green; fore femora with one preapical bristle on posterior surface and two rows of six short spines below; middle and hind femora each with one row of minute spines below (Oahu) .... *saxatilis* Grimshaw
3. Antennae wholly yellow, third joint rounded; palpi very large, pale yellow, leaf-like (Oahu) .... *pallidipalpus* new species
   Antennae wholly black 4
4. Cilia of the calypteres and of posterior orbits black; fore coxae yellowish brown at base; fore femora with nine spine-like bristles below on apical two-thirds, basal two the longest; face narrow, silvery white (Hawaii) .... *hawaiiensis* Grimshaw
   Inferior orbital cilia white; cilia of the calypteres black in the males, yellow in the females; fore coxae wholly yellow with black hairs (Oahu) .... *vulgaris* new species

Campsicnemus brevipes new species.

Male: Length 1.7 mm. Eyes almost touching in the middle of the face; face white pollinose; palpi small, black or brown; front largely black or

brown, but shinging green on each side at vertex (the rest of front may be discolored); antennae (Fig. 12) wholly black, first joint gray with pollen, at least on outer surface, third joint twice as long as width of base, pointed at tip, arista basal, black; lower orbital cilia, white.

Dorsum of thorax bright, but dark shining green, with a little brown pollen and coppery reflections (its bristles broken off in type); scutellum blue with violet reflections in the middle; pleura black. Abdomen black, depressed, its hairs largely yellowish; hypopygium black, conspicuous, rounded, with black appendages.

Coxae black, posterior ones with a long, erect bristle on ourter surface (cannot see the fore coxae very well); coxae, lower part of pleura and parts of femora with a peculiar silvery white pollen, which is visible in certain lights; front femora dark yellow, apparently blackened below; front tibiae and tarsi (Fig. 13) black, former with the tip yellowish; last joint of tarsi widened; middle femora yellow with little spines below, which give it a serrate appearance on apical half; middle tibiae and tarsi (Fig. 14) black, tibiae widened and with a small black hook at tip below, a long preapical bristle on one side and two short spines near apical fourth; first joint of tarsi less than half as long as second, with two fine, hair-like bristles below near base; hind femora, tibiae and tarsi yellow, but rather dark in color, femora with a pair of bristles below near basal third and one or two near tip; none very long; tibiae with small slender bristles above, which are recumbent, not at all outstanding; length of front tibiae as 32, middle 38 and posterior as 55; joints of front tarsi as 12-5-4-3-5; of middle pair 6-14-7-5-7; and of posterior pair as 15-17-9-7-8. Calypteres dark yellow with black cilia; halteres yellow.

Wings grayish (crumpled in type).

Holotype, male, taken by O. H. Swezey, May 2, 1920, at Waialae iki, Oahu.

Campsicnemus ciliatus new species.

Male: Length 1.7 mm. Eyes contiguous; upper facial triangle, front, antennae, palpi and occiput black; lower orbital cilia whitish.

Dorsum of thorax black with brown pollen; acrostichal bristles forming one row in front and two irregular rows posteriorly; five pairs of dorsocentrals, the front pair very small; bristles of the thorax black, but appearing whitish in certain lights, especially towards their tips; scutellum with two large bristles and two pairs of very small hairs on the margin; pleura black, anterior half more dark reddish brown, a yellow spot at root of wing; abdomen black.

All coxae blackish at base for more than half their length, more reddish brown or reddish yellow on apical part, anterior pair a little more yellowish; femora dark yellow, anterior pair infuscated at base; tibiae and tarsi pale yellow; middle tibiae (Fig. 15) slightly widened, somewhat fusiform, a bristle below at tip and one near basal fourth on lower posterior edge, also a row of long bristly hairs below on most of apical half, these hairs are yellow, but appear more brown in certain lights; all joints of middle tarsi ciliated below with rather long yellowish hairs; hind femora with several bristles below near tip; hind tibiae slender, with four bristles on upper

anterior edge and three on upper posterior edge; hind tarsi with rather long, but not stout hairs; middle tibiae as 38, posterior as 65; joints of front tarsi about as 15-6-4-4-5; middle pair as 17-12-9-6-7; of posterior pair as 14-15-10-7-7.

Wings grayish; third and fourth veins nearly straight and parallel, fourth ending a little back of apex of wing; last section of fifth vein about as 22, cross-vein as 6.

Holotype, male, taken by O. H. Swezey, May 18, 1932, on Mt. Kaala, Oahu.

The only specimen of this species in the collection is in poor condition. I could not see the form of third antennal joint or much of the abdomen; the wings are crumpled some and the front legs are mostly buried in glue. The characters given will no doubt be sufficient to identify the species when taken again, although the color of the legs and front may be found to differ from that given here when fresh specimens are obtained.

Campsicnemus concavus new species.

Male: Length 2 mm. Face narrow in the middle, wider above and below, its suture near lower fourth, face covered with yellowish gray tomentum, lower part with the tomentum wholly gray, somewhat heart shaped, as long as wide; palpi black, thickly covered with gray tomentum; proboscis black; front dark blue, somewhat shining; antennae wholly black, third joint somewhat conical in outline, slightly longer than wide, arista basal, pubescent; the cilia of the posterior orbits seem to be wholly black.

Dorsum of thorax dark blue, with several acrostichal bristles; four pairs of dorsocentral bristles of nearly equal length, except the posterior pair, which are longer; scutellum with one pair of marginal bristles; pleura blackish above, yellow below. Abdomen dark green with some blue reflections and black hair; hypopygium almost wholly concealed, but seems to be gray pollinose with stiff black hairs.

Fore coxae yellow with black hair, the hair near the tip long and stiff, a row of four or five rather small, slender bristles at tip; middle coxae mostly black; hind coxae largely yellow with one black, erect bristle on outer surface; all femora yellow, posterior pair (Fig. 16) flattened, wide when seen from above or below, when viewed from the side they are narrow and much curved, concave below, with a large preapical bristle and darkened tip; all tibiae dark yellow to brownish, almost brown; fore tibiae (Fig. 17) a little concave above, with a large bristle below just beyond the middle, and a small one at tip below; middle tibiae seem to have five bristles on upper anterior edge and two on upper posterior edge of basal half, below with two bristles on middle third; hind tibiae with four or five bristles above and four below, including those at tip; length of front tibiae as 37, of middle 59, and of posterior as 65; joints of fore tarsi as 20-8-6-5-5; of middle as 22-13-10-7-8; of posterior pair as 17-17-9-8-6. Knobs of halteres yellow.

Wings grayish; fourth vein ending in the apex of the wing; last section

of fifth vein a little curved, its length as 25, cross-vein about one-third as long as last section of fifth vein.

Described from one male, taken by F. X. Williams, in pool at Pauoa headwaters, Tantalus, Oahu, September 11, 1932, at 1,500 feet elevation. This is a water rider.

I should have taken this specimen to be a female, but as the fore tibiae and posterior femora are so decidedly modified it seems sure it must be a male, although the hypopygium is concealed.

Campsicnemus flavicornis new species.

Male: Length 2 mm. Face narrow above, brown, lower half with yellow tomentum; front blackish green; occiput black with a little white pollen; antennae (Fig. 18) yellow, third joint triangular, acutely pointed at tip, second joint larger than the first; orbital cilia wholly black.

Dorsum of thorax reddish, blackened a little in the middle, especially on posterior slope; no acrostichal bristles; four pairs of dorsocentral bristles; scutellum yellow with one pair of large marginal bristles; prothorax partly blackened, with one large black bristle above each fore coxa; pleura black on upper half, lower half pale yellow. Abdomen dull black, narrowly yellow at base, its hair black, posterior margin of segments narrowly white pollinose; hypopygium mostly concealed with small silvery white hairs, small black appendages visible below; central organ projecting a little backward, yellowish white, its sheath darker yellow.

All coxae and femora and anterior and posterior tibiae and tarsi pale yellow, outer surface of middle coxae with a large black spot, anterior surface with stiff black hair; front coxae with silvery white pollen, a few delicate hairs on upper part and three stiff black bristle-like hairs on lower half; hind coxae with one large, erect, black bristle on outer surface; all femora, tibiae and tarsi with rather short, black hair; front femora (Fig. 19) nearly bare below with only a few rather short hairs towards the tip; middle femora (Figs. 20 and 21) much thickened at base, slender towards tip, with two rows of long bristly hairs below; hind femora with a row of rather long hairs on lower posterior edge; front tibiae (Fig. 19) without bristles; middle tibiae (Figs. 20 and 21) black, without bristles, except at tip and a small one near base; they have a row of long stiff hairs above and below, those above becoming longer towards the tip; front basitarsi slender (Fig. 19) thicker at base; middle tarsi (Figs. 20 and 21) wholly black with long hair above, first joint with about sixteen very long, nearly erect hairs, which have their tips bent; hind tibiae with seven bristles above, below with a small bristle beyond the middle and one at tip; hind tarsi with first joint one-fifth shorter than second; length of front tibiae as 35, middle 53 and posterior as 70; joints of front tarsi as 25-10-10-6-6; of middle as 25-14-14-9-6; and of posterior as 20-25-15-10-9. Calypteres yellowish brown with dark yellowish cilia; halteres wholly pale yellow.

Wings brownish, in poor condition in the type.

Female: Front shining blue-green; third antennal joint very small; dorsum of thorax more blackish; two acrostichal bristles form the starting of a single row on the front of the thorax; four pairs of dorsocentrals; scu-

tellum yellowish, but darker than in male; pleura, coxae, femora, tibiae and tarsi colored about as in the male, except that the middle tibiae and tarsi are yellow like the rest; fore tibiae without a bristle; middle tibiae above with one bristle at basal sixth, one at basal third, and one at apical third, below with one at basal third, tip with three bristles; hind tibiae above with one bristle at basal and one at apical third, below with one at apical third; length of front tibiae as 38, middle as 64 and posterior as 82; joints of front tarsi as 23-10-8-7-5; of middle 30-14-12-7-5; posterior pair as 22-27-16-10-7. Front basitarsi straight; all tibiae and tarsi with short hair.

Holotype, male; allotype, female, and one female paratype, taken by F. X. Williams, April 19, 1931, on Mt. Kalena, Waianae Mountains, Oahu, at 3,500 feet elevation.

Another badly broken specimen may be the same as *flavicornis*, but the bent hairs on middle basitarsi are continued on the whole length of the tibiae, and the first joint of front tarsi seems to be straight, but are buried in the glue. It was taken by O. H. Swezey at Opaeula, Oahu, July 19, 1925.

Campsicnemus gloriosus new species.

Male: Length 1.7-2 mm. Face brownish black, sometimes metallic black, moderately wide below, eyes approximated above, coming closest at upper third, lower part nearly round and covered with golden yellow tomentum; palpi black with white hair; proboscis brown with a row of minute yellow hairs on the edge; front blue-green, steel-blue or violet, wide but short; ocellar-tubercle prominent; antennae (Fig. 22) wholly black, third joint triangular, long and rather slender; arista basal, pubescent; orbital cilia black, two or three hairs below yellowish white.

Dorsum of thorax shining black, pleura pale yellow on lower half or more; no acrostichal bristles; four pairs of dorsocentrals; scutellum shining dark blue-green, or blue with one pair of marginal bristles and three or four very minute hairs between them on the apical margin; prothorax with one large black bristle above each fore coxa. Abdomen depressed, dull black with a few pale yellow hairs on the dorsum and black hairs on lower edge of the sides; venter black; hypopygium mostly concealed.

Fore coxae wholly yellow with black hair and several small bristles; all tarsi and middle and hind coxae black, coxae with yellow tips, posterior pair with one black erect bristle on outer surface; all femora yellow with black hair, hind ones a little brown at tip; fore femora with three small black bristles near tip on lower anterior side and another small one close to the tip; hind femora nearly straight, scarcely thickened, with one preapical bristle on posterior surface and a row of about ten slender, black bristles below, the longest nearly as long as width of femora, also a black bristle near tip below; front tibiae yellow, without bristles; middle tibiae (Fig. 23) black, flattened and widened, curved, so as to be considerably concave on upper edge, below with slender bristles on basal half and long fine hair on apical half, its tip (Figs. 24 and 25) projecting beyond base of tarsi and with seven curved bristles above on tip, the apical ones very long, but rapidly becoming shorter, also a straight bristle below near apical fifth;

base of tibiae (Fig. 26) with a large, pale yellow, thumb-like projection near base; hind tibiae black, straight, moderately slender, above with a pair of bristles near basal fourth, three bristles on middle third, one at tip and a row of hairs on both upper and lower edges of posterior surface, which are as long as diameter of tibia; length of front tibiae as 45, of middle pair as 56 and of posterior pair 64; joints of front tarsi as 21-12-11-6-7; of middle as 28-18-10-8-8; posterior pair as 18-16-11-7-8. Calypteres brown with black cilia; halteres yellow with the knob black or more or less blackened.

Wings uniformly tinged with brown; third vein slightly bent back at tip; last section of fourth vein nearly straight, about parallel with third, ending just back of the apex of the wing; last section of fifth vein as 25, cross-vein as 9; posterior margin of wing evenly rounded.

Female: Face formed about as in the male, wholly brown, scarcely paler below; third antennal joint (Fig. 27) about half as long as in the male; all femora, tibiae and tarsi plain; front tibiae (Fig. 28) brownish with a bristle above and below near the middle; middle and hind tibiae black; middle tibiae (Fig. 29) above with one bristle at basal fourth, one before and one after the middle (sometimes the latter missing), and one above and below at tip, also one at first and second third below; hind tibiae above with one bristle at basal sixth, one just before the middle and one a little beyond apical third, below with a small bristle a little before and one a little after apical third; length of front tibiae as 45, middle 61 and hind ones as 73; joints of front tarsi as 23-9-8-7-7; of middle 26-14-11-8-9; of posterior pair as 20-17-11-10-7. Wings with the cross-vein one-third as long as last section of fifth vein; lower part of pleura sometimes yellowish brown; knobs of halteres vary from dark yellow to blackish, and hind coxae vary in color about the same.

Described from 94 specimens of water riders; holotype, male; allotype, female, and five paratypes, taken by F. X. Williams at Pauoa headwaters, Tantalus, Oahu, on water, at 1,400 feet elevation, on February 14, 1932; 15 paratypes, taken on pools at Pauoa headwaters, Tantalus, Oahu, September 11, 1932, at 1,400 feet elevation; two paratypes, at Pupukea, Oahu, March 6, 1932, at 1,800 feet elevation, and four paratypes at Pauoa headwaters, Oahu, March 15, 1931, on water. The other paratypes were taken at these locations, in the same months; all specimens were taken on the Island of Oahu. It may be found on the other Islands, but I have not seen specimens from them.

Campsicnemus grimshawi new species.

Male: Length 2 mm. Eyes broadly contiguous, lower facial triangle brown with white tomentum on the rounded lower part; front shining blue-green; antennae (Fig. 30) wholly black, third joint triangular, slightly longer than wide, obtuse at tip, arista basal, long with long pubescence occiput black with brown pollen; orbital cilia wholly black.

Dorsum of thorax black, dulled with brown pollen; acrostichal bristles in two irregular rows; five dorsocentrals in each row; scutellum blue with one pair of bristles and a few minute hairs between them on the posterior margin; lower part of pleura yellow or yellowish brown. Abdomen dull black, depressed, with pale hairs and black bristles, seen from the side the hair appears more black; hypopygium mostly concealed with white hairs on outer part.

Fore coxae yellow with black hairs on anterior surface and a row of bristles on outer edge of apical half and across the tip; middle and hind coxae black, latter with one large, black, erect bristle on outer side; all femora yellow, front pair (Fig. 31) with a few short, black hairs below; middle femora (Fig. 32) with long, delicate hairs below, ending in a few short stiff ones and one bristle near tip; hind femora narrowly black at tip, a large black bristle above near tip and short black hairs below; front tibiae (Fig. 31) yellow on basal half, apical half blackish, above with one rather small bristle just before the middle and one below just beyond middle; middle tibiae (Fig. 32) black, a conspicuous, somewhat triangular projection below near base, beyond this with a row of moderately short, erect, black hairs, which become long yellowish and numerous on apical half, ending in a long black bristle at tip, and with one moderately long bristle on the side at basal third; hind tibiae black wtih rather long black hair above and below, upper surface with six bristles and one at tip above and below; all tarsi black, plain, with moderately long black hair, on lower surface of middle ones the hair is as long as diameter of joints, those on fourth joint erect and bent at tip. Length of front tibiae as 45, middle 62 and posterior as 90; joints of front tarsi as 27-12-12-9-8; of middle as 35-16-10-8-8; of posterior pair as 23-20-12-8-9. Calypteres and their cilia black; halteres yellow or yellowish brown.

Wings tinged with blackish brown, darker in front; fork of second and third veins nearly opposite apical third of first vein; third and fourth veins nearly straight and parallel, fourth ending in apex of wing; last section of fifth vein straight, its length as 26, cross-vein as 8; wings rather wide, not elongated, anal angle rounded, but a little prominent.

Described from four males, all taken by Swezey and Williams in October, 1931, at Nauhi Gulch, Hawaii, at an elevation of about 5,000 feet on a forest pool; one female paratype was taken at the same time.

Campsicnemus nigricollis new species.

Male: Length 3 mm. All parts of head, the thorax, abdomen, legs, feet and all hairs and bristles black; wings uniformly blackish, only the scutellum green and shining.

Antennae (Fig. 33) black, third joint about as long as wide, rounded, arista basal; eyes contiguous, lower facial triangle large; orbital cilia wholly black; dorsum of thorax with several rather long acrostichal bristles near the middle of the thorax; three pairs of dorsocentrals; scutellum with one pair of large bristles and several small hairs near apical margin; front coxae (Fig. 34) with long hair; front femora with two rows of long hairs below and one preapical bristle; front tibiae (Fig. 34) with long hairs below

and two long bristles above on middle third; first joint of front tarsi with three bristles below near base, other joints with bristles above; middle femora (Fig. 35) with two large bristles near tip, one above and one below, also with long hair on lower part of apical third, middle tibiae with five bristles above, a row of blunt bristles on the side of basal two-thirds, continued to tip by slender, acutely pointed bristles and long hairs below on whole length, their basitarsi with long hair above, which is a little shorter towards tip; hind tibiae, femora and their hair mostly white, with seven bristles above and three at tip, two above and one below; their tarsi with long hair; length of front coxae as 36, trochanters 10, femora 62 and tibiae as 50; middle tibiae as 86 and hind tibiae 100; joints of front tarsi as 25-12-12-10-9; of middle pair 20-25-16-13-10; of hind pair as 23-25-16-6-9. Calypteres, their cilia, and the halteres black.

Wings (Fig. 36) with the first and base of second vein apparently coalescent; sixth vein straight; apex of wing between the tips of third and fourth veins; last section of fifth vein straight, its length as 40, cross-vein as 15.

Holotype, male, taken by F. X. Williams, November 15, 1931, on running water at Kokee, Kauai, at 3,500 feet elevation, with a note, "active water skater."

Campsicnemus obtusus new species.

Male: Lengh 2.6 mm.; of wing 3 mm. Eyes almost touching in the middle of the face, face black, lower part covered with golden yellow tomentum; palpi black with pale hairs and black bristles; front black, vertex dark blue; antennae (Fig. 37) black, third joint rounded at tip, a little longer than wide, not at all pointed at tip; arista basal, long, one-sixth shorter than front tibia; orbital cilia and bristles under the head wholly black.

Dorsum of thorax shining blue-black, but somewhat dulled with brown pollen, which leaves a median stripe that is more black and shining; can see several acrostichals and five pairs of dorsocentral bristles; scutellum with one pair of large marginal bristles; front of thorax and front and lower part of pleura are dark yellowish brown to reddish brown, humeri a little more yellowish. Abdomen black with black hairs, first segment covered with brown pollen; hypopygium forming a rather large, rounded tip to the abdomen, covered with gray pollen and white hairs on posterior surface, its appendages small, reddish yellow.

Coxae black to dark reddish brown, anterior pair with black hair on outer anterior surface, longer delicate pale hairs on inner part, a row of five long, slender, black bristles on the edge of the tip; femora yellow, their extreme tips a little blackened; all tibiae and tarsi black; front femora with one large and one very small bristle near tip on lower posterior surface; front tibiae (Fig. 38) with a large bristle at basal third of upper anterior surface, a larger one beyond the middle on lower posterior edge, one at middle on anterior surface and one near tip on posterior edge, also a row of little golden yellow scales at tip; front basitarsi with three or four little spines below; middle tibiae (Fig. 39) with three large bristles on upper posterior surface, two on lower posterior edge of basal half and two near tip on upper and lower sides of posterior surface; their tarsi with rather long hair

on both upper and lower edges of posterior surface; middle femora with one large bristle near tip on lower posterior edge; hind femora bowed outward and with a large preapical bristle on anterior surface and a smaller one on posterior side; hind tibiae with four pairs of large bristles on upper surface, the last pair near tip; below with two small bristles nearly on middle third and a larger one at tip; all tarsi with more or less white hair; length of front tibiae as 60, middle as 90 and posterior as 105; joints of front tarsi as 33-14-11-8-10; of middle pair 44-19-15-10-10; of posterior pair as 30-32-14-8-7. Calypteres and their cilia black; halteres black, basal half of their petiole yellow.

Wings uniformly a little tinged with brown; third and fourth veins straight and nearly parallel beyond the cross-vein, apex of the wing between their tips; fifth vein straight for its whole length, last section as 40, cross-vein as 16; sixth vein strong, straight, but not reaching the wing margin; anal angle of wing rounded off, not prominent.

Female. Antennae, color of face, front and palpi as in the male; coxae, femora, tibiae and tarsi colored about as in the male, except that the basal half of hind femora is sometimes a little blackened; length of front tibiae as 60, middle as 85 and posterior as 124; bristles of front tibiae about as in the male, but much shorter; joints of front tarsi as 42-15-11-7-7; of middle as 40-18-14-8-8; of posterior pair as 30-30-16-9-7.

Holotype, male; allotype, female, and four female paratypes, all taken by F. X. Williams, January 17, 1932, on Kaala, Waianae Mts., Oahu, on boggy poollet, at 4,000 feet elevation.

The females, if all are correctly placed, sometimes have all femora almost wholly yellow; dorsum of thorax with two distinct reddish-brown stripes, extending their whole length, the humeri quite yellow and fore coxae sometimes dark yellow. There seems to be some variation in the bristles of front tibia, but usually they are about as in the male, except smaller, in the others some of the bristles may be broken off.

Campsicnemus octosetosus new species.

Male: Length 2.7 mm. Face rather narrow and dull black above, wider and brown below, lower part with yellow tomentum (or large scales of yellow pollen), a little irregular on lower edge; palpi and proboscis brown with hairs which appear pale in certain lights; antennae (Fig. 40) black, rather long, third joint a little longer than wide and somewhat rounded at tip; front blue-black, mostly shining; orbital cilia black.

Dorsum of thorax shining black, reddish in front and rather widely along the sides, prothorax reddish yellow with one large black bristle above each front coxa; pleura wholly reddish yellow, only a little darkened near the dorso-pleural suture; cannot see any acrostichal bristles; there seem to be four pairs of dorsocentrals, the anterior pair small; scutellum with one pair of large bristles and several small hairs near apical margin. Abdomen dull black, depressed, its hair almost wholly black; hypopygium concealed, tip of abdomen a little enlarged.

Front coxae almost wholly yellow, anterior surface with short black hairs, outer side with a few yellow hairs and tip with black bristles; middle coxae wholly black, posterior pair yellow or yellowish brown with posterior surface black, one black erect bristle on outer surface; trochanters black to yellowish brown; all femora yellow with black hair, those below rather short, posterior pair very narrowly black at tip; all tarsi wholly black; front tibiae (Fig. 41) yellowish, brown above, with two very long bristles below on middle third, two smaller ones on posterior surface and a small one at tip above, also a row of close-set, moderately long hairs on upper and lower edges of anterior surface, their hair wholly black; fore basitarsi with rather long hair on lower anterior edge and a large bristle at the middle; middle and hind tibiae blackish wiith basal third or more yellowish, the hair on their sides white; middle pair (Fig. 42) with four bristles above, three smaller ones on posterior side, one at tip below and two on lower anterior edge, one at basal and one near apical third; posterior tibiae with eight bristles above in two rows, three large ones on lower anterior edge, one near the middle, one at apical fourth, and one at tip; middle and hind tarsi plain, except that the middle basitarsi are slightly arched, concave below, hairs on middle pair largely and those on hind ones wholly white or yellow; length of front tibiae as 55, middle 90 and posterior as 94; joints of front tarsi as 36-15-10-8-8; of middle 35-20-14-9-7; of posterior pair as 24-26-14-9-7. Calypteres and their cilia black, halteres yellowish with a brown knob.

Wings tinged with brown; third vein slightly bent backward toward tip, last section of fourth vein straight, apex of wing between their tips; last section of fifth vein as 32, of cross-vein as 10.

Female: form of antennae and general color of body and legs as in the male; front tibiae above with a large bristle at basal third and one near tip; below with a large bristle at apical third; front basitarsi without a bristle but with long hair below; bristles of middle and hind tibiae about as in the male; abdomen with a few pale hairs on basal segments.

Holotype, male, and allotype, female, taken by F. X. Williams, November 29, 1931, at Kahana, Oahu, on water, at an elevation of 2,000 feet; ten paratypes were also taken at the same place and time.

Campsicnemus ornatus new species.

Male: Length 1.7 mm. Eyes contiguous, almost completely obliterating the face; palpi reddish brown with black hairs and a little white pollen; first antennal joint yellow (other joints missing in the type); front shining, dark green.

Dorsum of thorax and scutellum shining, bright green; pleura yellow; can see no acrostichal bristles and only two pairs of dorsocentrals (others may be broken off). Abdomen shining green with yellowish hairs, depressed; hypopygium mostly concealed.

All coxae, femora, tibiae and tarsi wholly yellow; front coxae with a few yellow hairs and bristles; front tibiae (Fig. 43) one and a half times as long as their basitarsi, without bristles or long hair, their basitarsi curved, concave below, with a row of long hairs above; middle tibiae (Fig. 44) without bristles, except a small one at tip above, anterior surface with quite

dense, delicate, long, yellowish hairs on most of basal third, these are bent at tip and are continued to tip of tibia by two rows of bristle-like hairs, which are very slightly thickened in the middle, lower surface with a row of rather widely separated, slender, erect hairs, which are longer than diameter of tibia; middle tarsi slender with rather long hair; hind tibiae above with one bristle at basal fourth, one near apical third and one near tip, no bristles below; length of front tibiae as 30, middle 55 and of posterior as 70; joints of front tarsi as 20-10-10-6-6; of middle as 30-16-11-9-8; and of posterior as 21-25-18-9-8. Halteres yellow.

Wings grayish, rather broad; third and fourth veins nearly straight and parallel, fourth ending in the apex of the wing; last section of fifth vein straight, its length as 24, cross-vein as 9; anal angle of the wing rather prominent.

Holotype, male, taken on the Hawaiian Islands.

This specimen was one of several that were glued on strips of paper and had become detached, so I cannot be sure on which Island it was taken. The second and third joints of front tarsi together measure 20, and the articulation of the joints is near the middle of this distance. It is partly hidden by the wing, so I have marked them as 10-10.

Campsicnemus sinuatus new species.

Male: Length 2 mm. Face very narrow above, a little wider below, dull brown, lower edge with yellow hairs; palpi black with whitish hairs; front and occiput black with bluish reflections on the former; antennae (Fig. 45) black, third joint long, acutely pointed at tip, arista basal with long pubescence; lower orbital cilia wholly black.

Dorsum of thorax and scutellum shining black, more or less reddish in front and on the sides, in holotype almost wholly reddish brown and paler on the sides; pleura largely yellow, black around the root of the wing; no acrostichal bristles; only two pairs of dorsocentrals; scutellum rather narrow at base, semicircular, the marginal bristles seem to have been broken off; humeri and propleura reddish brown. Abdomen black with black hair, a few pale hairs at base and tip; abdomen depressed, a little enlarged at tip; hypopygium mostly concealed.

Front coxae yellow, very narrowly black at base, with rather long and quite abundant yellow hair; middle and hind coxae black; fore and middle femora yellow with black hair, anterior pair nearly bare below, but with a row of a few very small black hairs on lower edge, moderately thick towards the base; middle femora greatly thickened at base (Figs. 46 and 47) with two rows of quite long, black bristles on basal third; hind femora yellow at base and more or less yellow at tip, black on the middle and mostly black above, with eight black bristles below on apical two-thirds, these are longer than width of femora; hind tibiae black, above with four bristles, one at basal seventh, one at basal two sevenths, one before fourth seventh, and one above and below at tip, all of these rather small; middle tibiae (Figs. 46 and 47) black, more or less yellow at base and on the sides, flattened and irregularly widened, widest at apical third, bisinuous, with two rows of

bristle-like hairs below, which are shorter on basal third, above with long hairs, a cluster of longer hairs on the widest part at basal third, these have their tips bent at a right angle, the tibia has a small conical projection below at basal third, and basal part of tibia (Fig. 48) has two projections, a square one at base and a rounded one a little beyond base; fore tibiae with two very small bristles below on middle third; all tarsi plain, black with rather short hair; length of front tibiae as 42, middle 54 and posterior pair as 72; joints of front tarsi as 23-12-10-6-6; of middle pair 27-14-9-8-6; of posterior pair as 17-16-11-7-7. Calypteres, their cilia and the halteres black.

Wings uniformly tinged with brown; third and fourth veins straight and parallel beyond the cross-vein, fourth ending just back of the apex of the wing; last section of fifth vein as 23, cross-vein as 10; first vein short, reaching only one-third its length beyond the forking of second and third veins; wings long and of nearly equal width, anal angle of wing rounded off, not at all developed.

Female: Third antennal joint but little longer than wide, triangular; thorax more black above than in the male, pleura reddish brown; femora and tibiae yellow, posterior tibiae more or less blackened towards tip, with about five bristles above on basal half and one below near apical third; length of middle tibiae as 55, they are plain with two bristles above and two below on middle third, all these bristles moderately long; all femora without long hair or bristles below, their hair largely yellow. Otherwise very much as in the male.

Holotype, male; allotype, female, and one male paratype were all taken by Swezey and Williams in October, 1931, at Nauhi Gulch, Hawaii, at about 5,000 feet elevation, on forest pools.

Campsicnemus spinitibia new species.

Male: Length 3 mm. Face rather narrow, brown with a little bright yellow tomentum on lower part, which is rounded below; palpi black with rather long black hair and one bristle at tip; front brown pollinose; occiput dull black; antennae black, third joint somewhat triangular, about as long as wide, arista basal, pubescent; orbital cilia wholly black.

Thorax black; acrostichal bristles in a single row in front, in two rows in the middle of the dorsum; there seem to be five pairs of dorsocentral bristles; scutellum with one pair of large marginal bristles; pleura wholly black. Abdomen black, its hairs mostly black, a few pale hairs on apical segments; hypopygium concealed, tip of abdomen thick, but not enlarged, with a row of short bristles on posterior margin of last segment.

Front coxae yellowish brown with stiff, rather long, black hairs; middle and hind coxae black; all femora yellow, their tips more or less blackened, middle and hind ones for a considerable distance, all with black, bristle-like hairs below, posterior pair with two preapical bristles, one beyond the other, the one nearest the tip smaller; all tibiae and tarsi wholly black; front tibiae (Fig. 49) with one bristle above and a longer one below; hair above rather long on tibiae and tarsi, a row of long hair below on tibiae and tarsi and a small bristle above and below at tip of tibiae; middle tibiae (Fig. 50) with four long bristles above, three on anterior surface, three on lower posterior edge and a small one above and below at tip, their femora with three

bristles near tip; middle tarsi plain with only moderately long hairs; hind tibiae with four large bristles above, last one near tip, two large ones on lower posterior edge of the third fourth, a small bristle below at tip and about four on anterior surface; hind tarsi (Fig. 51) with moderately long hairs below on all joints, those on last four joints bent at tip; length of front tibiae as 45, middle 87 and posterior as 85; joints of front tarsi as 23-12-10-6-6; of middle as 30-19-17-10-9; of posterior pair as 18-22-18-11-10. Calypteres, their cilia and the halteres black.

Wings blackish; third and fourth veins nearly parallel, apex of wings about half way between their tips; last section of fifth vein straight, its length as 45, cross-vein as 18; wing rather wide, anal angle rather prominent.

Female: A female taken with these males has the color of the wings, body and legs about as in the male, except that the lower part of the pleura is dark reddish brown; front tibiae yellowish brown and the front shining blue.

Holotype, male; allotype, female, and one male paratype were taken by Swezey and Williams in October, 1931, at Nauhi Gulch, Hawaii, at an elevation of about 5,000 feet. "On creek pool."

Campsicnemus strigosus new species.

Male: Length 1.5 mm. Eyes contiguous; front shining steel-blue; palpi small reddish brown; antennae (Fig. 52) yellow, tip of third joint blackish, arista dorsal with long pubescence; lower orbital cilia whitish.

Dorsum of thorax bright green, with a little brown pollen; two rows of acrostichal bristles; can see two pairs of dorsocentrals, one near the suture and one in front (back part of dorsum injured by the pin in type); lower part of pleura yellow. Abdomen green, darker than thorax, with yellow hairs and bristles, a few black hairs on lower edge of sides; hypopygium conspicuous, metallic black, rounded, with a pair of minute black, triangular lamellae on lower inner corner.

Fore coxae wholly yellow, nearly bare, but with several minute white hairs; middle and hind coxae seem to be black; all femora, tibiae and tarsi wholly yellow, last joint of tarsi scarcely darker; front leg (Fig. 53) with the femora of somewhat equal width, a little narrowed near the middle from below, apical half hairy, basal half nearly bare; tibiae very narrow in the middle, normal only at base and tip, fringed with long hairs above and below, their basitarsi much curved, larger at base and tip, with a dense fringe of long black hairs below, the upper edge less densely fringed; middle leg (Fig. 54) with the femora much thickened, except the narrow apical part, in some positions there seems to be a depressed brownish spot below before the thin part, which bears a cluster of spines; tibiae flattened and apparently twisted (as it changes shape when seen from different angles), fringed above with long delicate yellow hairs, below with five or six long, black, hair-like bristles on basal third, without stout bristles above or below, except the apical spurs, their basitarsi with long hairs above, which are continued on the following joint, fourth joint very slender, fifth slender at base, slightly widened at tip; hind femora rather thick, their tibiae slender, with several very slender bristles, the one above near basal fourth the longest, it being a little longer than diameter of tibia; tarsi slender, especially the last

two joints; length of front tibiae as 26, of middle 54 and of posterior pair 75; joints of front tarsi as 20-7-8-6-6; of middle pair 25-14-10-8-6; posterior pair as 20-23-16-9-6. Calypteres yellow, broadly black at tip with black cilia; halteres pale yellow.

Wings a little grayish, rather long and narrow, of somewhat equal width; third and fourth veins nearly straight and parallel beyond the cross-vein, fourth ending in the apex of the wing; last section of fifth vein straight, its length as 25, cross-vein as 9, perpendicular with fourth vein; anal angle of wing rounded, not prominent.

Holotype, male, taken May 4, 1913, by O. H. Swezey, at Waiawa, Oahu.

Campsicnemus tibialis new species.

Male: Length 2 mm. Face narrow above, a little wider below, dark dull brown, lower part about as long as wide, a little pointed below, white pollinose; palpi black with black hair and one long bristle; proboscis yellowish brown with black hair; front and occiput dull black; antennae (Fig. 55) black, third joint about as long as wide, arista basal, pubescent; orbital cilia wholly black.

Dorsum of thorax, scutellum and abdomen dull black, lower part of pleura yellowish, upper part black; four pairs of long, yellowish brown acrostichal bristles in two irregular rows; four dorsocentrals in a row; two scutellar bristles; prothorax with one large black bristle above each front coxa. Abdomen depressed with long, delicate pale hairs and some stiff black hairs on the middle of the dorsum; hypopygium mostly concealed, but apical end of abdomen a little enlarged.

Front coxae dark yellow, a little blackened at tip, with black, bristle-like hairs; middle and hind coxae black, latter with one large erect bristle on outer surface; all femora dark yellow, more or less blackened, especially at tip, their hair mostly black; front femora (Fig. 56) with black bristles below near tip and rather long black hair on the middle of lower surface, also a row of longer pale hairs; hind femora with rather long black hair below, ending in three bristles near tip of lower posterior edge; front tibiae (Fig. 56) yellowish brown with one bristle above near middle, below with a slender one near tip and on lower anterior edge a row of long pale hairs; middle tibiae (Fig. 57) black with a row of close-set, moderately long, black hairs on lower posterior edge, a row of long slender, nearly erect hairs on upper posterior surface and a row of about twelve long, slender, blunt bristles on basal two-thirds of lower anterior surface; hind tibiae (Fig. 58) black with five long bristles above and three shorter ones below on apical half, also a row of stiff black hairs on lower posterior edge; front basitarsi with hairs below, which are long at base, shorter towards tip; all tarsi black with rather long black hair; length of front tibiae as 48, middle 61 and posterior as 73; joints of front tarsi as 24-12-11-8-5; of middle as 33-17-12-9-8; posterior pair as 15-16-11-8-8. Calypteres black with yellowish cilia; knobs of halteres black, stem yellow.

Wings uniformly blackish; third and fourth veins straight and parallel, apex of wing between their tips; last section of fifth vein slightly arched, its length as 34, cross-vein 14; fork of second and third veins about opposite

middle of first vein; wing long and narrow, of nearly equal width, anal angle rounded, but a little prominent.

Female: General color about as in the male; antenna (Fig. 59); front shining, slightly metallic; face wholly black; all legs and feet with moderately long hair and bristles; fore femora and tibiae with their hair mostly yellowish; tibiae with a long bristle below and a smaller one above near the middle; middle and hind femora and tibiae with their hair mostly black, but middle tibiae with a row of yellowish hairs below; middle tibiae above with one bristle near basal fifth, a pair near second fifth and at tip one above and below; middle tibiae below with one bristle at basal fourth, one before the middle and one before apical fourth; hind tibiae above with one bristle at basal sixth, one at second sixth, one at apical two thirds, another a little beyond that and one near tip, none below; length of front tibiae as 54, of middle 82 and of posterior as 95; joints of front tarsi as 32-13-12-8-7; of middle 37-28-12-10-8; of posterior pair as 27-25-16-10-10; lower part of pleura yellowish; halteres yellowish; wings broader than in the male; fourth vein ending nearly in the apex of the wing; anal angle rounded off; last section of fifth vein straight, its length as 34, cross-vein as 18.

Holotype, male; allotype, female, and eleven paratypes, all taken by Swezey and Williams, October, 1931, in Nauhi Gulch, Hawaii, at an elevation of about 5,000 feet, on forest pools.

Campsicnemus williamsi new species.

Male: Length 2-3 mm. Face narrow, a little wider below with a little yellow pollen, lower part nearly round, covered with rather large scales of yellow, almost golden pollen; palpi black with long black hair; front shining blue-green; occiput black; antennae (Fig. 60) black, first joint long, third scarcely as long as first, its tip a little rounded, arista basal, long, pubescent; ocellar-tubercle prominent; orbital cilia wholly black.

Dorsum of thorax and the scutellum shining black, usually the sides of the dorsum a little reddish, sometimes broadly reddish on the sides and the lateral corners of the scutellum; I see one acrostichal bristle in one specimen, but most have none; there are three pairs of dorsocentrals and one pair of large scutellar bristles; prothorax with one large black bristle above each fore coxa; humeri usually reddish or yellowish brown; lower part of pleura reddish yellow to yellowish brown. Abdomen dull black with many small white hairs on the dorsum, depressed; hypopygium and last abdominal segment apically a little enlarged; hypopygium and its appendages mostly concealed.

Front coxae and all femora wholly yellow; hairs on fore coxae yellow; middle coxae black with abundant black hair on anterior surface; hind coxae yellowish brown with one small, erect, black bristle on outer surface; hairs on fore femora mostly yellow including the long ones below, but some of those at base are black at root, they have five small, hair-like, black bristles below near the base and one rather short, stout bristle near tip on lower posterior edge; middle and hind femora with their hair mostly black, as are also the slender bristles below; middle femora (Fig. 62) with a cluster of stout, black bristles below in the middle and a large hook at tip above, the size of this hook seems to vary in different individuals; hind

femora straight, not thickened, with about eight long, black, bristle-like hairs below on apical half and a large black bristle both above and below at apical sixth; hind tibiae black, upper surface with one bristle at basal sixth, one near basal fourth, one near basal third and one near the tip, below with a small bristle before basal sixth, a pair of small ones just beyond the middle and one at tip; middle tibiae (Fig. 62) black, flattened and widened irregularly, with a large cluster of very long hairs above beyond the middle, one very long bristle and two short ones on the side of apical third, besides other long hairs and bristles above and below; front tibiae (Fig. 61) yellowish brown, swollen near the middle and with long hair above and below, they have three very long, stout bristles above near the middle and three very long, but more slender bristles on posterior side of apical half; front basitarsi with long hair above and below, that above very long at base of joint; only moderately long at tip, this long hair is continued on the following joints, but is only moderately long; length of front tibiae as 50, middle tibiae 63 and posterior pair as 85; joints of front tarsi as 36-17-10-8-8; of middle pair 38-17-10-7-7; of posterior pair as 23-24-14-9-7. All tarsi black or brown. Calypteres, their cilia and the halteres black, sometimes the stem of the halteres is yellowish brown.

Wings uniformly tinged with dark brown, veins blackish; third and fourth veins straight and parallel, apex of wing between their tips; last section of fifth vein straight, its length in the large male as 32, cross-vein 15, in a small male the last section of fifth vein is as 27, cross-vein as 9; wings somewhat long and narrow, a little narrowed at base, but a little prominent at anal angle.

Female: Head parts and the wings as in the male, third antennal joint only a little shorter; color of body and legs as in the male, except that the lower part of the pleura is more brown, scarcely at all yellowish and the fore and middle femora are a little blackish above and below; length of front tibiae as 52, of middle 92 and of posterior 97; fore tibiae with one bristle above at basal two fifths and two at tip; one above and one below; middle tibiae above with one bristle a little before and one beyond the middle and one near apical third, below with one beyond the middle and one at apical third, also one above and one below at tip; hind tibiae above with one bristle at basal sixth, one beyond basal third and one at apical third, below with one beyond basal third and one beyond apical third, also one above and one below at tip; joints of front tarsi as 35-15-12-9-8; middle as 44-19-11-8-9; of posterior pair as 25-26-14-9-8.

Holotype, male; allotype, female, and five paratypes, taken by F. X. Williams, January 17, 1932, on boggy poollet on Mt. Kaala, Oahu, at 4,000 feet elevation, and five paratypes, taken November 29 and February 8, 1931, on poollets on Kahana ridge, Koolau range, Oahu, at 2,000 feet elevation.

Am naming this in honor of Dr. Williams, whose faithful work in collecting these interesting little flies has brought to light so many new forms of this genus.

Campsicnemus miritibialis new species.

Male: Length 2.4-2.6 mm.; of wing 3.5-4 mm. Face, front, palpi and proboscis black, face rather wide, a little narrowed in the middle; antennae black, third joint about as long as wide, conical in outline, arista as long as height of eyes; posterior orbits with a few black cilia above, a few pale hairs on the lower part of the black occiput.

Thorax and abdomen wholly black, somewhat shining, dorsum of thorax with a little brown pollen; acrostichal bristles in two irregular rows, very small; four pairs of dorsocentrals; scutellum with one pair of large marginal bristles; abdomen with black hairs; hypopygium partly visible, with a portion extending forward under the venter (this may be the lamellae), posteriorly near the dorsum is a small rounded part, covered with little black hairs, this is partly concealed, but I should take it for the outer lamellae if it was not for the part extending under the venter.

Legs and feet wholly black, except the fore coxae, all trochanters, extreme base of femora, and more or less of lower edge of front femora, which are usually yellowish brown; fore coxae with numerous long black hairs; fore femora rather wide, with long black bristles below on apical half, and a large preapical bristle on the side; middle femora wide when seen from the side, with two rows of moderately long bristles below; hind femora (Fig. 83) much widened when seen from the side, with two rows of long bristles below, seen from above (Fig. 80) much curved, concave posteriorly, and with long bristle-like hairs on both anterior and posterior edges of lower surface; fore tibiae (Fig. 81) with two large bristles above, near first and second thirds, and long, rather delicate hairs below; fore tarsi with fine, erect pile below, and long hair above; pulvilli large, almost concealing the claws in the drawing (Fig. 81). Middle tibiae (Fig. 82) very much widened, widest near apical third, where there are two long, pointed appendages above, beyond these the tibiae are much narrowed, but still much wider than normally found, they are fringed above and below with long hairs, several above near the points are longer than width of tibiae, near the tip is a yellowish brown lobe above, at apical end of this lobe is a short, thick, clavate or capitate appendage, below near the center are four long, erect bristles; middle tibiae with long white hairs on posterior surface, especially towards the apex, many of the hairs above also seem to be white; first joint of middle tarsi (Fig. 82) rather short, large, with an upturned horn-like tip, and a few long hairs above, second joint rather slender, attached to first near its base, on lower edge, this joint has fine, dense pile below, and long hairs above; third, fourth and fifth joints with moderately long hairs below and fine, dense, erect pile above, there are also a few long hairs above; hind tibiae (Fig. 83) with six bristles above and two below, besides the four bristles at tip, on basal two thirds they have a row of long, and more or less erect hairs, besides the usual recumbent hairs; hind tarsi (Fig. 83) with the base of last four joints narrowed, all joints with long hair above, below with rather long but scarcely erect pile, which is longest on first joint, the first two joints also have several slender, rather short bristles below; length of front tibiae as 51, of middle ones 64 and of posterior measured straight across about as 65, when measured on the curved side about as 80; length of hind tibiae as 88; joints of fore tarsi as 25-16-15-10-9; of middle tarsi, first joint from base to tip of point as 16, the following

joints as 25-17-12-10; joints of hind tarsi as 20-18-14-10-12. Calypteres, their cilia and the halteres black.

Wings blackish, rather long and narrow, but with the anal angle quite prominent; last section of fifth vein straight; last section of fourth vein slightly farther from third at its middle than at the cross-vein or tip, apex of wing between the tips of third and fourth veins; last section of fifth vein as 21, of cross-vein as 11.

Female: Almost like the male in color and the form of the wings, except that the fore coxae and base of fore femora are a little more yellowish; middle tibiae and tarsi plain; joints of fore tarsi as 30-13-8-6-10, of middle tarsi as 32-18-10-8-9; of hind tarsi as 30-18-16-11-12; front tibiae with one large bristle above and one below; hind femora bent about as in the male; all femora without large bristles below, but with a few rather long hairs on lower surface.

Holotype, male; allotype, female, and eight male paratypes and five female paratypes were taken by F. X. Williams, August 13, 1933, on running water at Waihi iki, Manoa, Honolulu, Oahu, and one female paratype was taken at Pauoa headwaters, Oahu, May 8, 1932, at an elevation of 1,400 feet.

Campsicnemus crinitibia new species.

Male: Length 1.8 mm.; of wing 2.3 mm. Face rather narrow, reddish, lower part nearly round, yellowish; cheeks reddish; palpi brown; proboscis black; front black with brown pollen; antennae (Fig. 84) black, third joint acutely pointed, with long pubescence; a few stout black orbital cilia above, and a very few pale hairs on the lower part of head.

Dorsum of thorax shining dark blue, scutellum blue-green with one pair of bristles, no acrostichal bristles; can see only two pairs of dorsocentrals; pleura blackish above, yellow on more than lower half. Abdomen black with greenish reflections; last segments on the sides, and the hypopygium with white hairs; hypopygium mostly concealed.

Coxae and femora pale yellow; fore coxae with a few small black hairs, especially on inner side of anterior surface; front femora with a few rather long hairs below; middle femora (Fig. 85) much widened on basal half or more, then narrowing to nearly normal, with a large protuberance below, before the tip, the widened basal half has many bristles on the flattened lower surface, which are arranged in four rows, the bristles in the two anterior rows are the longest and reach nearer to the protuberance than the shorter bristles in the two posterior rows; posterior femora only moderately thickened, with five bristles on lower surface, which are of decreasing length, with the longest near the basal third, and shortest near tip; fore tibiae with one bristle below near apical third, without bristles above; middle tibiae (Figs. 86 and 87) irregularly widened on apical two-thirds or more, and with a long thumb-like protuberance at base, rather dark yellow with a wide blackish ring near basal third on widened part; on basal third of lower surface there is a row of very short, stout spines, beyond these are rather slender, erect hairs; above with long delicate hairs where the tibiae widens, and beyond the middle a cluster of very long hairs, also a number of longer hairs near the tip; all tarsi plain; fore and middle knees

blackened; hind tibiae with about seven bristles on upper surface, below with rather long hair, and one small very slender bristle near the middle; length of front tibiae as 42, of middle pair as 53, and of posterior pair as 67; joints of front tarsi as 17-11-9-7-7; of middle pair as (Fig. 87) 27-13-10-8-8; of posterior pair as 20-18-12-7-6. Calypteres yellowish brown with black cilia; halteres pale yellow.

Wings grayish, veins brown; third and fourth veins parallel beyond the cross-vein; last section of fifth vein nearly straight, its length as 21, cross-vein as 9.

Holotype, male, taken by F. X. Williams, April 13, 1933, in the Kamokuiki Valley, Waianae Mts., Oahu, at 950 feet elevation, on water.

Campsicnemus nudifemorata new species.

Male: Length 1.5 mm. Eyes contiguous, leaving a black triangle below, which is a little white pollinose; antennae (Fig. 88) black, all three joints of nearly equal size, third joint rounded at apex, bare, arista slender with rather erect hairs, its tip lamelliform; front black, shining.

Thorax and abdomen shining black, without noticeable metallic color; hypopygium small, black.

Front coxae wholly yellow, but rather dark, with a few small black hairs, near the tip with rather long, hair-like bristles; middle and hind coxae blackish, broadly dark yellow at tip; femora, tibiae and fore and hind tarsi yellow; apical third of middle tibiae and their tarsi a little blackened. fore tarsi becoming brownish towards their tips, hind tarsi a little brownish apically; fore and middle femora nearly bare, without hair or bristles below or at tip on the sides; hind femora very thick, nearly straight, with a large bristle at apical sixth of posterior surface, without hair below; front tibiae without bristles, and with only short hair; first joint of fore tarsi with a row of bristle-like hairs below on whole length, these are of equal size and a little longer than the diameter of the joint; middle femora (Fig. 89) moderately thickened, narrowed before the tip; middle tibiae (Fig. 89) arched, concave below, and a little narrowed in the middle, with short hair, except on apical fourth of lower surface, and near the base above; first joint of middle tarsi (Fig. 89) very short, with a tooth above at base, and long hairs and bristles; second joint long, arched, concave above, with long hair above, and slender, erect, bristle-like hairs below, last three joints very short; hind tibiae with a row of nearly erect, rather long hairs on upper, anterior edge and two or three small bristles; length of front tibiae as 30, of middle pair 55, and of posterior pair as 59; joints of front tarsi about as 15-5-5-5-5; of middle pair as 7-30-5-4-4; joints of posterior pair as 11-20-8-7-6. Halteres blackish-brown. Wings crumpled in type.

Holotype, male, taken by F. X. Williams, August 13, 1933, at Waihi iki, Manoa, Honolulu, Oahu.

This is very much like *patellifer* Grimshaw, but the following characters given by Grimshaw differ from this specimen as mentioned in the above description: Front, dark brown; third

antennal joint hairy; halteres, bright yellow; abdomen, dull blackish brown; middle femora very much thickened on basal two-thirds with two rows of very conspicuous black bristles on the thickened portion, also two moderately sized bristles below near tip; first joint of middle tarsi with two long spines. The type is in poor condition, but as it differs in all these characters I do not think it can be the same species.

Campsicnemus bellulus new species.

Male: Length 1.5 mm. Face very narrow, linear on upper half, widening into the low part, which is nearly round and silvery white; palpi rather pale brown; front black with brown pollen; antennae black, third joint acutely pointed, about as in *crinitibia* (Fig. 84); lower orbital cilia pale.

Thorax and scutellum light yellow, pleura with a large blackish spot below the root of the wing; no acrostichal bristles; scutellum with one pair of large bristles; three pairs of dorsocentrals; bristles of the thorax black; abdomen black with black hair; hypopygium and its appendages black, mostly concealed.

All coxae, femora, tibiae and tarsi pale yellow, tarsi scarcely darker at tip; all femora almost whitish, hind femora with two small bristles near the tip on posterior surface, and a long one at apical fourth below, otherwise bare on lower half; middle femora (Fig. 91) moderately thick at base, with a small bristle on each side at tip, three long slender ones at base below, which are continued towards tip by shorter stout bristle-like hairs; fore femora with a small bristle near tip on posterior side, otherwise wholly bare on lower three-fourths; fore tibiae without noticeable bristles; middle tibiae (Figs. 90 and 91) thickened, irregularly widened, with a rounded protuberance at base, and long, rather stout, nearly erect, wavy hairs below, above with long fine wavy hairs on apical half, which are mostly yellow, and a moderately large bristle near tip; middle basitarsi (Fig. 91) with two little bristles above, at first and second thirds, otherwise the fore and middle tarsi are plain and slender; hind tarsi with first joint three-fourths as long as second, rather thick, each of the following joints becoming more slender than the preceding one; length of fore tibiae as 33, of middle pair 36, and of posterior pair as 55; joints of fore tarsi as about 16-9-8-5-6; of middle pair 38-14-11-8-7; of posterior pair as 15-21-7-6-7. Calypteres yellow with black cilia; halteres yellow.

Wings narrow, a little grayish, veins yellowish; third and fourth veins straight and nearly parallel beyond the cross-vein, but a very little farther apart at wing margin; fourth vein ending in the apex of the wing; last section of fifth vein slightly curved, its length as 19; cross-vein at right angles to fourth vein, its length as 6.

Holotype, male, taken by F. X. Williams, October 9, 1932, at Tantalus, Oahu, on a wet spot.

Campsicnemus divergens new species.

Male: Length 1.7 mm.; of wing 2 mm. Face and front black, eyes almost touching in the middle of the face, leaving rather long gray triangles

above and below; palpi black; first two antennal joints yellow, third brown, hairy, about as long as wide, obtuse at tip.

Dorsum of thorax and the scutellum greenish-black, a little shining; no acrostichal bristles; three pairs of dorsocentrals; scutellum with one pair of large marginal bristles; thorax with black bristles; abdomen blackish with green or bronze reflections, and black hair and bristles; hypopygium small, rounded posteriorly with several small bristles, but mostly concealed.

Coxae yellowish, femora and tibiae yellow, fore femora with a broad blackish ring near the middle, and a small bristle near the tip on posterior surface; fore tibiae without bristles, their apical third and their tarsi darker; middle femora (Fig. 92) with a bristle near tip on posterior side, bare below; middle tibiae (Fig. 92) with a pair of bristles near base, and one above and below beyond the middle, also one at tip below, their hair wholly short and recumbent; posterior femora bowed outward when viewed from above, with a bristle on each side near tip, nearly bare below, they are moderately thickened almost to their tip; hind tibiae with two bristles above, none below; all tarsi plain, except that the hind tarsi have first joint a little thickened and about six-sevenths as long as second joint; middle and hind tarsi scarcely darkened towards their tips; length of front tibiae as 32, of middle pair 50, and of posterior pair as 66; joints of fore tarsi as 32-8-7-4-6; of middle pair as 25-13-9-7-6; of posterior pair as 18-21-13-9-6. Calypteres blackish, with a few pale cilia; halteres pale yellow.

Wings grayish, rather narrow; third and fourth veins nearly straight from the root of the wing, distinctly divergent, the apex of the wing between their tips; last section of fifth vein nearly straight, its length as 30, cross-vein as 10.

Female: Almost like the male in color and form, but the third antennal joint seems to be more yellow, third and fourth veins are slightly less divergent and front femora and tibiae wholly yellow.

Described from ten specimens, taken by Swezey and Williams, September 30, and October 1-3, 1931. Holotype, male, and allotype, female, taken October 1, 1931, in Nauhi Gulch, at 5,000-6,000 feet elevation. All were taken in Nauhi Gulch. Those labeled October 1st were swept from the foliage of Broussaisia, and those taken October 2 were swept from the foliage of lehua (*Metrosideros*), by O. H. Swezey.

This comes nearest to *rectus* Malloch, but differs as in the table of species.

Table of Species of Campsicnemus Known to Be Found in the Hawaiian Islands.

1. Femora, tibiae and tarsi black 2
   Femora and usually the tibiae yellow, or mostly yellow 3
2. Middle tibiae not, or scarcely widened, with a row of slender, blunt bristles on the side (Kokee, Kauai Island) .... *nigricollis* Van Duzee

Middle tibiae greatly widened, with a pair of acutely pointed horns on upper surface, near apical third; middle basitarsi short, thick, with an upturned, horn-like point at tip, second joint inserted near its base on lower surface (Oahu) .... *miritibialis* Van Duzee

3. Arista plain as usual........ 4
Arista with a lamella at tip........ 25

4. Upper surface of front tibiae with three bristles, which are as long as the front basitarsi, these basitarsi have very long hair at base, which becomes shorter towards their tips; middle tibiae with very long, dense hair above; middle tibiae with a large hook at tip (Oahu)........ *williamsi* Van Duzee
Only middle tibiae with unusually long hair or bristles, and often their hair and bristles only moderately long........ 5

5. Middle tibiae with a rounded projection near base........ 6
Middle tibiae without a projection at base........ 10

6. Middle tibiae with about five very long, curved, stout bristles at their apex, the tip of the tibiae extending beyond the base of their tarsi (Oahu)........ *gloriosus* Van Duzee
Middle tibiae without long bristles at their tips, their tarsi attached to the tip of the tibiae as usual 7

7. Middle tibiae widened, very crooked and sinuous, with long hair on the edges, especially on upper apical half (Hawaii).. *sinuatus* Van Duzee
Middle tibiae a little arched, not or but little sinuous 8

8. Middle tibiae gently bent, not widened, rather slender, fringed with moderately long hairs below, which are twice as long as the diameter of tibia; third antennal joint longer than wide, obtusely pointed at tip (Hawaii)........ *grimshawi* Van Duzee
Middle tibiae a little concave, below, considerably widened on apical two-thirds or more; third antennal joint long, acutely pointed at tip 9

9. Middle tibiae of somewhat irregular outline, but of nearly equal width on apical three-fourths, and with a conspicuous cluster of long hairs above, beyond the middle, also with hairs not as long on upper surface, especially near base and tip, middle basitarsi without bristles; basal half of middle femora very much thickened (Oahu)........ *crinitibia* Van Duzee
Middle tibiae seen from the side, evenly rounded below on apical two-thirds, with rather long hair on both upper and lower edges, and a bristle above near tip; viewed from above, the middle tibiae widening towards the tip, narrowing abruptly a little before the apex, with long hair on the edge on widest part, a few bristle-like hairs on the other side; middle femora moderately widened at base, and with three moderately long bristles near base below; middle basitarsi with two small bristles above (Oahu)........ *bellulus* Van Duzee

10. Middle tibiae widened or thickened........ 11
Middle tibiae not or scarcely widened, thickened or flattened 15

11. Antennae black........ 12
Antennae yellow, or reddish yellow, at least mostly yellowish at base. 13

12. Middle tibiae greatly widened in the middle, somewhat fusiform; middle tarsi with long hair below, first joint longer than second (Oahu)........ *ciliatus* Van Duzee

Middle tibiae much widened, with a small hook at tip below; first joint of middle tarsi about twice as long as wide, shorter than second, and with two fine hair-like bristles below (Oahu)..........*brevipes* Van Duzee

13. First joint of middle tarsi greatly widened, leaf-like, about twice as wide as long, shorter than second, and with a bristle on one side; middle tibiae with apical part much widened, very thin and twisted (Hawaii) ....*distortipes* Grimshaw

First joint of middle tarsi not leaf-like; apical part of middle tibiae not widened, twisted or very thin.......... 14

14. Fore tibiae short, about as long as the basitarsi, slender, especially in the middle; middle basitarsi bent in nearly a quarter circle, a little enlarged at extreme base; first joint of middle tarsi twice as long as second, plain (Oahu)..........*strigosus* Van Duzee

Front tibiae normal, much longer than their basitarsi; middle tibiae slightly thickened on apical third, with fine hairs, mostly erect, above, and a bristle on each side near apex; below with a group of black, short bristles, in three rows near apical third; middle basitarsi slightly curved, not half as long as second joint, the anterior dorsal angle slightly produced, and tipped with a curved, black thorn; bristles of thorax yellow (Hawaii)..........*congregatus* Malloch

15. Middle tibiae with a row of long, slender, blunt bristles on one side (Hawaii)..........*tibialis* Van Duzee

Middle tibiae without a row of blunt bristles.......... 16

16. Middle basitarsi shorter than the following joint, with an erect spur at tip; middle tibiae with a row of very short, erect bristles or spines below, and a row of longer bristles or bristle-like hairs above on their whole length; third antennal joint brown, basal joints paler (Molokai Mts., Molokai)..........*calcaratus* Grimshaw

First joint of middle tarsi longer than second, or not much shorter...... 17

17. Antennae wholly yellow, or with the first joint yellow.......... 18

Antennae wholly black, or dark brown.......... 22

18. Middle tibiae slightly curved, with four large bristles above, below with about ten longer bristle-like hairs, or slender bristles (Hawaii).......... ....*fimbriatus* Grimshaw

Middle tibiae above with a pair of bristles near base and one beyond the middle, below with one bristle beyond the middle and one at tip, no erect hairs or bristles below; hind tarsi with first joint six-sevenths as long as second; antennae yellow with third joint brown (Hawaii).......... ....*divergens* Van Duzee

Middle tibiae with one bristle above near base, besides those at tip.. 19

19. Hairs and bristles of the thorax yellowish; antennae yellow; middle tibiae with a rather strong, black bristle close to the base on anterior surface, and a short spine on lower anterior surface near tip; middle tarsi with second joint six-sevenths as long as first, and with a straight, forward-directed, brownish spur at tip (Oahu).......... ....*inermipes* Malloch

Hairs and bristles of thorax black.......... 20

20. Middle tibiae with a series of short, erect, delicate hairs on lower posterior surface, and a short bristle above near base on anterior edge; third antennal joint brownish; hind basitarsi three-fourths as long as second joint (Oahu)..........*rectus* Malloch

Middle tibiae with a rather close row of long, blunt hairs either above or below; first joint of hind tarsi three-fourths as long as second.... 21

21. Front basitarsi arched, concave above, with rather long hairs below; middle tibiae with small, slender, erect spines above on basal two-thirds, arched, concave above, lower surface with a row of long, delicate hairs, of nearly equal length, which have their tips bent; tarsi plain (Oahu)..*ornatus* Van Duzee

Front basitarsi slightly arched, concave below, a little enlarged at base; middle tibiae straight with a bristle near base above, and three at tip, a row of long, fine hairs of nearly equal length on the whole of upper surface, these hairs have their tips bent; middle basitarsi straight, with about sixteen long, slender, curved hairs above (Oahu)..*flavicornis* Van Duzee

22. Middle tibiae above with about seven bristles, in two rows, also two or three large bristles below.. 23

Middle tibiae with three or four bristles above, one of which is at the tip, and one at tip below, sometimes there are two or three more bristles below near the middle.. 24

23. Front tibiae without a bristle above, somewhat concave on dorsal edge, below with a large bristle near the middle, and a small one near tip; hind femora flattened, wide when seen from above, much curved, concave below when seen from the side; middle tibiae on upper surface with about five bristles on anterior surface, and two on posterior edge of basal half, below with two bristles on middle third (Oahu)..*concavus* Van Duzee

Front tibiae nearly straight, with a bristle above before the middle and one below beyond the middle; hind femora nearly normal; middle tibiae with two rows of bristles above, one of four and the other of three bristles, below with three large bristles, near first, second and third fourths (Hawaii)..*spinitibia* Van Duzee

24. Front tibiae with two large bristles on middle third of lower surface, two small ones on posterior surface, and one above at tip; front basitarsi with one bristle near the middle on posterior surface; middle tibiae with four large bristles above, one of which is at tip, one bristle at tip below, and three on posterior side, which are rather small, also two small bristles on lower anterior edge; posterior tibiae with eight large bristles above, in two rows, three large bristles on lower anterior edge, one at basal and one at apical fourth, the other near the middle, also one at tip below (Oahu)..*octosetosus* Van Duzee

Front tibiae with one large bristle above at apical third of posterior edge, a larger one at basal third of upper anterior edge, and a still larger one beyond the middle of lower surface, also one at tip on posterior surface; fore basitarsi with three small spines below; middle tibiae with four large bristles above, one of which is at the tip, two on lower posterior edge of basal half, two near basal third below, and one at tip below; third antennal joint about as long as wide, rounded at tip (Oahu)..*obtusus* Van Duzee

25. Third antennal joint hairy; middle femora greatly thickened on basal two-thirds, with two rows of large, black bristles below on thickened portion; halteres bright yellow (Oahu)..*patellifer* Grimshaw

Third antennal joint bare; middle femora only moderately thickened, wholly bare below, without hair or bristles; halteres wholly black (Oahu) .... *nudifemorata* Van Duzee

Syntormon distortitarsis new species.

Male: Length 2.5-3 mm. Face narrow, silvery white; front broad, violet or violet-blue, shining; occiput nearly opaque with brown pollen; antenna (Fig. 63) black, third joint long, tapering into a long narrow point; second joint extending thumb-like over third on inner side for nearly the length of first joint, arista apical, a little shorter than third joint; palpi and proboscis black; orbital cilia black, a few of the lower hairs brown.

Dorsum of thorax and the scutellum green with slight blue reflections, sometimes wholly blue, dorsum dulled with brown pollen; acrostichals large, in a single row, ending in a pair just before the depressed posterior slope of thorax; six dorsocentrals in each row; one large and two small humeral bristles, two posthumeral, two presutural and one superalar bristle, scutellum with one pair of large marginal bristles and a pair of small hairs on the margin near base; prothorax with short white hairs above front coxae; pleura mostly black, white pruinose, a little green on anterior part; abdomen green or blue, white pollinose, incisures and hairs black, sometimes the sides and one or two of the incisures yellow; hypopygium (Fig. 64) large for the genus, metallic, its appendages conspicuous and black.

Fore coxae yellow, dark at base with white hair and one black bristle; middle and hind coxae black; middle coxae with white hair and one black bristle on anterior surface, hind ones with one black bristle on outer side; trochanters, femora, tibiae and basitarsi yellow, sometimes whole of fore and middle tarsi yellow; sometimes hind tibiae and tarsi brown or blackish, only a little yellowish at base of tibiae; front and posterior femora with one, middle femora with two preapical bristles, the outer one on middle femora slender; all femora nearly bare below; fore tibiae with stiff hairs above and one bristle near basal third, below with one bristle near middle; middle tibiae with one bristle above near middle; hind tibiae with four bristles on upper posterior edge and quite dense, rather long hairs on both lower anterior and posterior edges, especially on apical half; fore tarsi (Fig. 65) with tip of first joint enlarged and fifth a little widened; hind tarsi (Fig. 66) with first joint thick and with a bristle at tip, second joint with basal part short and with a thumb-like projection on one side nearly as long as basal part and extending nearly parallel with third joint, bearing many stiff, black, curved hairs; length of front tibiae as 48, of middle 73 and of posterior as 90; joints of fore tarsi as 26-13-11-6-7; of middle as 35-17-12-7-7; of posterior pair as 22-12 over all (basal part 6, projection 7)-8-8. Calypteres yellow, sometimes brownish with yellow cilia, which has the base of the bristles more or less black; halteres pale yellow.

Wings gray, slightly brownish in front, rather long and narrow, widest at the posterior cross-vein, anal angle of wing a little prominent; third vein bent backward at tip, where it approaches fourth a little; last section of fourth vein nearly straight, ending in the apex of the wing; last section of fifth vein nearly straight, its length as 21, cross-vein as 16.

Female: Face wide, blue with only a little white pollen; lower edge considerably projecting; antenna (Fig. 67) small, third joint nearly round, very slightly angled at tip, arista subapical, nearly twice as long as antenna;

orbital cilia black; all femora yellow; color of thorax, its bristles and the color of abdomen about as in the male; wings as in the male; fifth joint of fore tarsi slightly widened; joints of fore tarsi as 29-15-10-7-7; of middle 39-16-11-7-8; of posterior pair as 23-23-17-10-9. Calypteres black, their cilia mostly black.

Described from eight males and twelve females. Holotype, male, and allotype, female, were taken by F. X. Williams, July 24, 1932, in Hering Valley, Tantalus, Oahu, the male hovering over the female, on wet rocks; two male and six female paratypes were taken at the same place and time; one pair of paratypes at Mana, Kauai, March 9, 1917, by O. H. Swezey; one male, three females at Honolulu, Oahu, on windows, by O. H. Swezey; and one pair at Pauoa headwaters, Tantalus, Oahu, February 14, 1932, at 1,400 feet elevation, by F. X. Williams.

The antenna in this species is formed a little like those of the European *pallipes*, but the hind tarsi are very different. I know of no described species of Syntormon with the second joint of hind tarsi modified as in this form.*

It is a little like the genus Pycsymnus Frey, but that genus seems nearer related to Sympycnus, agreeing with Syntormon in having the hind tarsi modified, but the first joint very short in the male, and an apical arista. All known species are from Formosa and the Philippine Islands.

EURYNOGASTER new genus

A new genus of Sympycninae; differing from Sympycnus in having the cross-vein longer than the last section of fifth vein; the abdomen of both sexes depressed when seen from above, in the male the abdomen is more or less clavate or widened below before its tip, in the female the abdomen is rather pointed when viewed from above or from the side, and the posterior part of the thorax has a conspicuous depressed and somewhat concave area before the scutellum.

Face of male rather wide, that of female only a little wider; first antennal joint bare above; third joint something like that of Sympycnus, arista dorsal, nearly bare or slightly pubescent. The depressed area on posterior part of thorax distinctly concave and large; no acrostichal bristles; five pairs of large dorsocentrals; scutellum with one pair of large marginal bristles. Abdomen in the male seen from the side (Figs. 69, 71 and 74) clavate, or conspicuously widened below at posterior margin of fourth or fifth segment; sixth segment small, seventh very narrow, but visible; hypopygium concealed or more or less conspicuous. Wings with the first vein reaching half way from the root of the wing to the cross-vein; third and

* It comes nearest to *flexibilis* Becker from Formosa, but that species has the third antennal joint very small, pear-shaped with a subapical arista; first joint of hind tarsi rounded below, widest in the middle, and second joint extending but little beyond base of third joint.

fourth veins approach each other very slightly beyond the cross-vein, but are parallel at tip; cross-vein a little longer than the last section of fifth vein in the males, but in the female the cross-vein is a little shorter than the last section of fifth vein; sixth vein represented by a slight fold of dark coloring in the wing membrane where the base of the vein should be; middle and hind femora with one preapical bristle; hind coxae with a large, erect bristle on outer surface; first joint of hind tarsi a little longer than second joint.

Type of genus *Eurynogaster clavaticauda* new species.

Table of Hawaiian Species

1. Hypopygium conspicuously projecting, almost free, extending downward and a little forward; fourth abdominal segment widened below (Figs. 71 and 72) .... *nitida* new species
   Hypopygium small, partly or wholly concealed 2
2. Fifth abdominal segment greatly enlarged, abdomen strongly clavate when seen from the side; face long, extending below the lower margin of the eyes (Figs. 68, 69 and 70) .... *clavaticauda* new species
   Fifth abdominal segment moderately widened below; face scarcely reaching lower margin of the eyes (Figs. 73 and 74). .....*virida* new species

Eurynogaster clavaticauda new species.

Male: Length 2.1 mm. Face silvery white, moderately narrow with its sides nearly parallel on lower three-fourths, slightly wider above, nearly six times as long as width of middle, its suture near apical fourth, lower part twice as long as wide, rounded below, reaching below lower margin of eyes and to the middle of the palpi; front green, with brown pollen; palpi and proboscis black; antennae (Fig. 68) black, first joint without hair above, second rather large with small bristles on apical margin, third joint about one and a half times as long as wide, arista dorsal, not quite twice as long as the antenna, both antenna and arista nearly bare; the orbital cilia seem to be wholly black.

Dorsum of thorax blue-green, shining, but with brown pollen, the large depressed, slightly concave area before the scutellum and the scutellum blue; no acrostichal bristles; five pairs of dorsocentrals, scutellum with one pair of very large marginal bristles; pleura black with some green reflections; posterior part of thorax below the abdomen pale yellow. Abdomen bronze-green with black hair, seen from above it is depressed and somewhat pointed at tip, seen from the side (Fig. 69) greatly enlarged below at posterior margin of fourth segment; sixth segment small, seventh very narrow; hypopygium reddish brown, its appendages largely concealed, black, fringed with short hairs.

Front coxae reddish brown with a few black hairs on anterior surface and five bristles at tip; middle and hind coxae reddish brown to black, their tips more or less yellow; posterior pair with one large, erect bristle on outer surface; all femora and tibiae yellow, tips of posterior tibiae enlarged and somewhat blackened; tarsi yellow, more or less darkened from tip of first joint; fore femora with a rather small bristle below near tip, middle and hind femora each with a rather large preapical bristle, middle ones also with a row of bristles below; front tibiae with a small bristle above near basal fourth, none below; middle tibiae (Fig. 70) with several large bristles below near the middle, which are continued nearly to base and tip by smaller

ones, above with one large bristle near basal third and one near the middle, also three at tip; hind tibiae above with a pair of long bristles at basal fifth and one large one near apical third, tips with three bristles; length of fore tibiae as 50, of middle pair 53 and posterior pair as 96; last joint of all tarsi a little flattened and widened; joints of fore tarsi as 29-15-11-8-9; of middle ones 41-21-16-9-7; posterior pair as 30-23-17-10-10. Calypteres yellow with black cilia.

Wings grayish hyaline; first vein reaching half way from root of wing to the cross-vein, which is beyond the middle of the wing; third vein bent back a very little towards its tip, so as to slightly approach fourth at tip; last section of fourth vein nearly straight, except that it bends back a little to meet the cross-vein, ending a little back of the apex of the wing; last section of fifth vein straight, its length as 19, cross-vein a little arched, so as to be a little convex towards apex of wing, its length as 21; anal angle of wing rounded off, not at all prominent.

Female: Face a little wider and slightly shorter than in the male; the rest of the head and the thorax about as in the male; abdomen depressed, tapering to the tip, which is rather pointed when seen from above or from the side, its hair black, or mostly black, tip of abdomen with a few rather long, bristle-like hairs; all coxae black with black hairs and bristles; fore tibiae with a bristle at basal third; middle tibiae with a bristle above at basal fifth and one below before the middle; hind tibiae about as in the male; fore and hind tibiae without bristles below; length of fore tibiae as 53, of middle pair 68 and of posterior pair as 88; joints of fore tarsi as 30-17-12-8-8; of middle pair 46-23-12-10-8; of posterior pair as 35-29-17-9-8. Halteres yellow, knobs darker yellow; wings about as in the male, except that the cross-vein is as 18 and last section of fifth vein is as 23.

Holotype, male, and allotype, female, were taken by O. H. Swezey, May 18, 1920, on Mt. Kaala, Oahu; three paratypes were taken at the same time and place.

Eurynogaster nitida new species.

Male. Length 2.3 mm. Face wholly white pollinose, rather wide above, half as wide at lower margin of eyes as at the antennae, extending considerably below the eyes, its suture rather indistinct, but upper part about two and a half times as long as the lower portion, which is rounded below; front green, somewhat dulled with grayish brown pollen; palpi black, moderately large with pale hairs; proboscis and first two antennal joints black (third joint broken off in type); first joint bare above; can see only a few small black orbital cilia on lower half of posterior orbits.

Dorsum of thorax, scutellum and abdomen shining green, with slight blue reflections; no acrostichal bristles; five pairs of moderately large dorsocentrals; scutellum with one pair of large marginal bristles, there are also several very small hairs on the margin; posterior part of thorax with a conspicuous concave area before the scutellum; hairs on the abdomen yellowish, one or more black bristles on posterior margin of each segment near lower edge; seen from the side the abdomen (Fig. 71) is widened below at the posterior edge of fourth segment; fifth segment rapidly narrowed apically; sixth segment small; seventh very narrow; hypopygium large, brown, extending far beyond seventh segment, its base extending nearly to base of

fifth abdominal segment; outer lamellae black with a spine-like tip and delicate hairs.

Front coxae yellow with several small black hairs on inner edge of anterior surface and three small bristles at tip; middle and hind coxae black, former with black hair, the latter with one large, black, erect bristle on outer side; all femora, tibiae and tarsi pale yellow, hind tarsi a little blackened towards tip; fore femora with a small, middle and hind femora with one large preapical bristle; middle femora (Fig. 72) with a large bristle below before its middle and beyond this five smaller bristles; fore tibiae with a small bristle above near basal third, none below; middle tibiae with one large bristle above near basal fifth and two smaller ones at tip, below with a row of long hairs, the longest near basal third and decreasing a little in length towards tip; hind tibiae with two large bristles above, one near basal third and one beyond the middle, two bristles at tip, one above and one below, no bristles below except the one at tip; length of front tibiae as 42, of middle 62 and of posterior as 65; joints of front tarsi as 26-14-11-6-7; of middle pair 37-20-16-7-6; of posterior pair as 29-24-14-10-7. Calypteres and their cilia dark yellow; halteres blackish.

Wings grayish; first vein scarcely reaching half way from root of wing to cross-vein, which is beyond the middle of the wing; third and fourth veins slightly convergent beyond the cross-vein, parallel at tip, fourth ending in the apex of the wing; last section of fifth vein straight, its length as 13, cross-vein bent outwards, so as to be convex towards apex of wing, its length as 18; sixth vein represented by a slight fold in the wing membrane where its base should be; anal angle of wing rounded off, not at all prominent.

Holotype, male, taken by O. H. Swezey, April 29, 1920, at Kaumana, Hawaii. Type in rather poor condition, having been eaten by museum pests.

Eurynogaster virida new species.

Male: Length 2.2 mm. Face rather wide, its sides nearly parallel, but widened a little on upper third; wholly white pollinose, reaching nearly to lower margin of the eyes, its suture near apical third, lower portion as long as wide, rounded below; front green, dulled with grayish brown pollen; palpi black with pale hairs; proboscis thick, black; antennae (Fig. 73) black, first joint bare above, third about as long as wide, tip rounded, arista inserted near middle of upper edge, where there is an offset on upper margin, arista short pubescent.

Thorax, scutellum and abdomen bright shining green with some bronze reflections; thorax with a little grayish pollen and a conspicuous depressed, somewhat concave area before the scutellum; no acrostichal bristles; five pairs of dorsocentrals; scutellum with one pair of marginal bristles; abdomen with black hair, seen from above it is depressed, seen from the side (Fig. 74) with fifth segment widened at apical margin below; fourth segment also a very little widened apically; seventh segment very narrow, mostly concealed; hypopygium concealed, but with a pair of lamellae projecting from the hollowed posterior apex of the abdomen, these are mostly black and fringed with long delicate pale hairs.

Fore coxae yellow, middle and hind coxae black, posterior pair with a large black erect bristle on outer surface; all femora, tibiae and tarsi yellow, last joint of fore tarsi brown, middle and hind tarsi a little darkened towards their tips; fore femora without bristles; middle femora with one large preapical bristle; hind femora bowed outward when seen from above, with a preapical bristle, which is placed near apical third; front tibiae with a small bristle above near base; middle tibiae above with three bristles near basal fifth and one near basal two-fifths; upper surface of posterior tibiae with one moderately large bristle near basal fourth, a small one near three-fourths their length, besides these there are several at tip; middle basitarsi with a row of little bristles below, which are as long as diameter of joint; first joint of hind tarsi with a rather large bristle at tip; length of fore tibiae as 68, of middle pair 85 and of posterior pair as 100; joints of fore tarsi as 44-28-18-10-7; of middle pair as 50-31-19-12-6; and of posterior pair as 40-37-21-12-8. Calypteres yellow with black tip, their cilia partly yellowish and partly black; knobs of halteres yellow, stem black.

Wings grayish; third and fourth veins slightly convergent beyond the cross-vein, but parallel at tip, fourth ending in the apex of the wing; last section of fifth vein straight, not reaching the margin of wing, its length to wing margin as 13, cross-vein as 22; sixth vein represented by a dark shade where its base should be; anal angle rounded off, not at all prominent.

Holotype, male, taken by O. H. Swezey, May 18, 1920, on Mt. Kaala, Oahu.

Medetera hawaiiensis new species.

Male: Length 2.3 mm. Face, front, palpi and occiput black, with a little gray pollen; face moderately wide, slightly narrowed in the middle; antennae black; third joint about as long as wide, conical in outline, arista apical, with very short pubescence; upper orbital cilia black, lower part of occiput with several whitish hairs.

Dorsum of thorax and the scutellum black, with a little white pollen; bristles and hairs of the thorax black; acrostichal bristles in two distinct rows; can see but two pairs of dorsocentrals; prothorax with one black bristle and a black hair above each fore coxa; scutellum with one pair of large marginal bristles, placed rather far apart. Abdomen black, with abundant white hairs on the dorsum; hypopygium black, almost glabrous, with a few little white hairs on the side, its appendages are a little yellowish brown.

Coxae and basal part of femora black, apical part of femora, the tibia and tarsi yellow; femora with short hair, no long hairs below; middle tibiae with a very small bristle near base; tarsi a little darkened towards their tips; length of front tibiae as 45, of middle the same, of posterior as 51; joints of fore tarsi as 23-17-12-7-7; of middle tarsi as 35-18-13-6-4; of posterior pair as 15-30-16-9-7. Calypteres yellowish brown with white cilia; halteres black.

Wings grayish hyaline, veins yellowish, brown towards the apex of wing; venation about as usual in the genus; last section of fifth vein as 17, cross-vein as 13.

Holotype, male, taken by Swezey and Williams, October, 1931, at Nauhi Gulch, Hawaii, at an elevation of between 5,000-6,000 feet.

Medetera atrata new species.

Male: Length 2 mm. Face wholly shining black; front dull black; antennae black, third joint scarcely longer than second, somewhat rounded, arista black, subapical, very short pubescent; upper orbital cilia black, a few of the lower cilia white.

Thorax black; dorsum thickly covered with greenish-gray pollen, the pollen on the sides of middle third more yellowish gray, a broad reddish brown, median stripe has a row of acrostichal bristles on each edge; two or three pairs of dorsocentrals; two pairs of scutellar bristles; prothorax with two white bristles above each front coxa; hairs on front part of thorax black with a few yellow ones on the front slope. Abdomen black with white pollen and with white hairs, on the dorsum long and abundant; hypopygium wholly shining black, the usual white pollinose space on the left side, which is covered with small white hairs; hypopygium thick and moderately long its lamellae blackish brown with a slight reddish tinge.

Coxae and trochanters black, posterior coxae with one erect white bristle on outer surface; all femora reddish brown to yellowish brown, more or less blackened at base; tibiae and tarsi yellow; all femora nearly bare below with a few yellowish white hairs on the sides and above, posterior pair with a few long, yellowish, stiff hairs at base above; hairs on the tibiae and tarsi of hind feet wholly yellowish white, on fore and middle tibiae and tarsi black above, yellowish white on lower part; anterior and posterior tibiae without bristles, middle tibiae with one rather small black bristle on upper posterior edge at basal sixth; length of fore tibiae as 53, of middle as 62; joints of fore tarsi as 21-21-14-7-7; of middle as 40-24-17-9-5; of posterior pair as 17-40-21-9-8. Calypteres reddish brown with white cilia; halteres dark yellow almost reddish brown.

Wings nearly hyaline, veins yellow; third and fourth veins convergent; last section of fifth vein as 16, cross-vein as 13; posterior margin of wing evenly rounded, anal angle rounded, not prominent.

Female: Color, form of wings and tarsi about as in the male; fore coxae with white hair; face bluish-green; femora colored about as in the male.

Described from one male and two females, taken by Swezey, August 7, 1924, at Honolulu, Oahu.

This differs from *cilifemorata* new species by having the first and second joints of fore tarsi of equal length, femora darker in color; hypopygium wholly shining black, its lamellae blackish and the face of the male shining black.

Medetera cilifemorata new species.

Male: Length 2 mm. Face below the suture dark blue-green, above opaque with grayish brown pollen; front mostly grayish brown; occiput black with grayish pollen above, shining black below; antennae black, third joint small, rounded, sometimes a little notched at tip where the arista is inserted, arista yellowish brown with very short pubescence; orbital cilia white, a few above black; palpi black with white pollen and yellow hairs.

Dorsum of thorax green, thickly covered with gray pollen, usually with a rather broad, brownish, medial stripe, in which the two rows of acrostichal

bristles are inserted, these bristles are reddish yellow when seen in certain lights, black when viewed from other angles, the hairs on fore part of thorax are of the same color; there are two pairs of long posterior dorsocentral and two small ones near the middle of the thorax, and are then continued to the front of the dorsum by small hairs; there are two humeral, one posthumeral, one presutural, two superalar, one postalar and two notopleural bristles; scutellum with two pairs of stout but not very long marginal bristles; prothorax with two white bristles above front coxae, the upper one slender. Abdomen green with white pollen and hair, some of the hairs on the sides appear black; hypopygium large at base, of moderate length, in the holotype shining black, except at tip where it is reddish yellow below, in the paratypes it is more largely yellowish or reddish yellow, its lamellae yellow with white hairs.

All coxae and trochanters black, fore and middle ones with white hair, hind ones with one erect, white bristle on outer side; all femora, tibiae and tarsi wholly yellow; hairs on fore and middle femora and tibiae mostly black, on lower part of middle tibiae the hairs are yellow; hairs on hind femora yellow including the row of long ones above, at base of femora these hairs are bristle-like and half as long as width of femora, decreasing in length, being very short at tip; hind tibiae slightly enlarged at tip, its hair wholly white, short, a few longer ones below at tip; anterior and posterior tibiae without bristles, middle tibiae with a small black bristle above and a yellow one on anterior surface near basal fifth; all tarsi plain, slender, fore and middle ones with short black hair; posterior tarsi with short white hair; length of fore tibiae as 55, of middle ones as 64; joints of fore tarsi as 25-20-14-7-7; of middle pair as 44-24-15-7-7; posterior pair as 16-38-21-9-8. Calypteres white with yellow margin and white cilia. Halteres pale yellow.

Wings nearly hyaline, veins yellow, third and fourth veins convergent; last section of fifth vein as 17, cross-vein as 15; posterior margin of wing nearly evenly rounded; anal angle rounded.

Female: about as in the male in general color and form of wings and feet.

Described from five males and two females, all taken by O. H. Swezey, at Honolulu, Oahu. Holotype, male, taken on a window; allotype, female, in cage in the insectary, December 3, 1914; two male paratypes were reared from compost, February 2, 1925.

Table of Species of Medetera Found in the Hawaiian Islands

1. All femora, tibiae and tarsi wholly yellow; scutellum with two pairs of bristles (Oahu)............ *cilifemorata* Van Duzee
   Femora more or less blackened at base............ 2
2. Prothorax with white bristles above fore coxae; scutellum with two pairs of bristles; halteres yellow or slightly brownish yellow; first two joints of front tarsi as 21-21; first two joints of hind tarsi as 17-40 (Oahu)............ *atrata* Van Duzee
   Prothorax with black bristles above front coxae; scutellum with only one pair of bristles; halteres black; first two joints of front tarsi as 23-17; first two joints of posterior tarsi as 15-30 (Hawaii)............ *hawaiiensis* Van Duzee

SWEZIELLA new genus

Rather small species of Thinophilinae, differing from the species of Thinophilus in having the last section of fifth vein considerably shorter than the cross-vein; a distinct depression on posterior part of thorax and the proboscis long, something like the proboscis of Coracocephalus.

First antennal joint bare above, third a little longer than second, arista dorsal with very short pubescence, face of male nearly as wide as front, proboscis nearly as long as the face; palpi rather large; thorax with a depressed area on posterior slope of thorax before the scutellum; no acrostichal bristles; five pairs of dorsocentral bristles, all large; abdomen depressed, first five segments tapering; sixth and seventh segments widened, wider than those preceding them; seventh very narrow, but of nearly equal width throughout; hypopygium extending forward under the venter, about as in Thinophilus, reaching nearly to second segment, and with a pair of converging, lamella-like organs above it; wings with third and fourth veins nearly parallel; cross-vein considerably longer than the last section of fifth vein; legs long and slender; first joint of hind tarsi a little longer than second.

Sweziella albifacies new species.

Male: Length 4.3 mm. Front and face wholly covered with white pollen, face only a little narrower than the front, slightly narrower below, more than twice as long as the front, its suture a little above apical fourth, lower part as long as wide, obtusely pointed below; palpi black with white hairs and thickly white pollinose; proboscis reddish brown, about as long as the face, bent forward towards the tip in the type; antennae (Fig. 75) black, second joint rather large, third rounded at tip, as long as wide with scales of white pollen, but scarcely hairy, arista dorsal with very short pubescence, not quite three times as long as the antennae; a few rather long, pale hairs on posterior part of head.

Dorsum of thorax greenish, almost brown, with thin white pollen; on the posterior part is a large depressed area before the scutellum, which is more shining green; there are no acrostichal bristles; five pairs of large dorsocentral bristles, the anterior ones only a little smaller than the posterior; scutellum rather wide and short with one pair of large marginal bristles; pleura brown with white pollen.

Abdomen (Fig. 76) green, white pollinose, its hairs mostly black, it is depressed as in Thinophilus, narrowed towards tip as far as hind margin of fifth segment, but widened again to apical margin of sixth segment; seventh segment visible, narrow and of nearly equal width throughout; upper half of posterior end of abdomen hollow and projecting out of it near the middle of its vertical height is a pair of lamella-like organs, which are convergent, fringed with long hairs and project a little beyond the base of the hypopygium (Fig. 77), the hypopygium (Fig. 76) at its base comes up to these organs, or a little between them, it is composed of four segments, the last small, extending forward under the venter to a little in front of the posterior margin of second ventral segment.

Front coxae wholly yellow with a few small yellow hairs; middle and hind coxae reddish brown, more black at base on outer surface, posterior pair with a large, erect bristle on outer surface; all femora, tibiae and tarsi yellow, tarsi more or less blackened towards their tips; femora without

longer hairs below, posterior pair each with one small preapical bristle; front tibiae without bristles; middle and hind tibiae each with one bristle above near basal fourth, one near the middle and one at tip; length of fore tibiae as 35, of middle as 118 and of posterior pair as 130; joints of fore tarsi as 50-24-17-10-9; of middle pair as 59-35-19-10-8; of posterior pair as 48-43-25-15-10. Calypteres and their long cilia yellowish; halteres yellow.

Wings grayish; first vein scarcely reaching half way to the cross-vein, which is beyond the middle of the wing; third vein gradually, but only a little bent backward towards tip, so as to approach fourth vein a little at tip; last section of fourth vein straight, ending in the apex of the wing; last section of fifth vein as 17, cross-vein bent in the middle, its convex side towards apex of wing, its length as 27; sixth vein almost wholly wanting, just its base present; wings somewhat narrowed at base, the anal angle being rounded off.

Described from one male, taken by O. H. Swezey, May 18, 1920, on Mt. Kaala, Oahu. This male is the type of both the genus and species.

Hydrophorus pacificus new species.

Male and female: Length 4-5 mm.; of wing 4.5-5 mm. Whole fly, including legs, more or less densely white pruinose, but the ground color conspicuous on the thorax and abdomen. Face broad, wholly white pollinose, the green ground color is slightly visible; front with the brownish ground color showing, except on the broadly white pollinose orbits, seen from in front it is wholly white pollinose; cheeks forming a small lobe below the eyes, about half as wide as third antennal joint; palpi and proboscis white pollinose; antennae black, small, of about the usual shape, arista a little longer than antenna; one pair of postvertical bristles; nine black postorbital bristles, which reach down to the middle of the eye; beard white, mixed with black hairs, not very long or abundant.

Thorax green, dorsum sometimes reddish coppery with the humeri and narrow lines where the dorsocentral bristles are inserted white pollinose; acrostichal bristles in a single row, two or three humeral bristles; four scutellar bristles; prothorax with one black bristle and two or three black hairs above fore coxae, above these are a cluster of white hairs; anterior part of mesonotum with black hair; twelve or fourteen dorsocentrals in each row, one presutural, three superalar bristles; pleura with a row of minute white hairs above and in front of middle coxae. Abdomen green, hairs on the dorsum largely black and very small; on the venter white and rather short; hypopygium of male mostly or wholly concealed, shining black; fifth ventral segment projecting downward a little (if it were not for this projection it would be difficult to separate the sexes).

Fore and middle coxae with white hair, former with a black bristle near tip, hind coxae without hair or bristle; all legs and feet black, femora usually a little greenish, fore femora (Fig. 78, showing lower surface) thickened on basal part, with four rows of spines below, the anterior and posterior rows reach apical sixth, middle rows end near the middle, hairs on the sides black, on upper and lower surfaces yellowish white; fore tibiae (Fig. 79) with a rather close row of moderately long spines below, with one large spine at tip, hair on anterior surface white, on upper and posterior surface black or

mostly black, it also has three small bristles on posterior surface; hair on middle and hind femora largely black, whitish on lower and posterior sides, hairs on their tibiae and all tarsi mostly black; middle femora straight, hind femora bowed outward; length of fore femora as 85, fore tibiae as 65; joints of front tarsi as 35-16-16-12-11; of middle pair 54-30-25-19-14; of posterior pair as 45-23-27-17-15. Calypteres yellow with white hairs; halteres pale yellow.

Wings nearly hyaline; costa yellow on basal two-thirds; first vein and base of third and fourth veins yellow, remainder of the veins brown; fifth vein from the cross-vein to wing margin as 24, cross-vein as 17; usually the fifth vein does not extend much beyond the cross-vein, but sometimes reaches the wing margin.

Described from four males and seven females, all taken on the Island of Oahu by F. X. Williams in 1931; holotype, male, at Honouliuli, April 5; allotype, female, at Haleiwa, April 11.

This is much like *praecox* Lehm., the wing veins being colored as in that species, and the form of the male hypopygium about the same; but in *praecox* the hairs are almost wholly white on both body and legs, and the fore femora have one row of spines below in the male and two rows in the female.

Explanation of figures.

Plate 22

Fig. 1. *Chrysosoma fraternum* new species, antenna of male.
Fig. 2. *Chrysosoma fraternum* new species, tip of antennal arista of male.
Fig. 3. *Chrysosoma fraternum* new species, hypopygium of male.
Fig. 4. *Chrysosoma fraternum* new species, organ projecting from middle of lamellae of the hypopygium.
Fig. 5. *Chrysosoma pallidicornis* Grimshaw, hypopygium of male.
Fig. 6. *Chrysotus vulgaris* new species, mid tarsus of male, side view.
Fig. 7. *Chrysotus vulgaris* new species, hind tarsus of male.
Fig. 8. *Chrysotus spiniger* Grimshaw, antenna of male.
Fig. 9. *Chrysotus spiniger* Grimshaw, mid femur of male.
Fig. 10. *Chrysotus pallidipalpus* new species, antenna of male.
Fig. 11. *Chrysotus pallidipalpus* new species, palpus of male.
Fig. 12. *Campsicnemus brevipes* new species, antenna of male.
Fig. 13. *Campsicnemus brevipes* new species, front tibia and tarsus of male.
Fig. 14. *Campsicnemus brevipes* new species, mid tibia and tarsus of male.
Fig. 15. *Campsicnemus ciliatus* new species, mid tibia and tarsus of male.
Fig. 16. *Campsicnemus concavus* new species, hind femur of male, side view.
Fig. 17. *Campsicnemus concavus* new species, front tibia and basitarsus of male.
Fig. 18. *Campsicnemus flavicornis* new species, antenna of male.
Fig. 19. *Campsicnemus flavicornis* new species, front leg of male.
Fig. 20. *Campsicnemus flavicornis* new species, mid leg of male.
Fig. 21. *Campsicnemus flavicornis* new species, mid leg of male, another view.
Fig. 22. *Campsicnemus gloriosus* new species, antenna of male.
Fig. 23. *Campsicnemus gloriosus* new species, mid femur, tibia and basitarsus of male.
Fig. 24. *Campsicnemus gloriosus* new species, tip of mid tibia and basitarsus, showing the bristles straight.
Fig. 25. *Campsicnemus gloriosus* new species, tip of mid tibia, showing the bristles curved.
Fig. 26. *Campsicnemus gloriosus* new species, base of mid tibia, showing projection on the side.
Fig. 27. *Campsicnemus gloriosus* new species, antenna of female.
Fig. 28. *Campsicnemus gloriosus* new species, front tibia and tarsus of female.
Fig. 29. *Campsicnemus gloriosus* new species, mid femur, tibia and tarsus of female.
Fig. 30. *Campsicnemus grimshawi* new species, antenna of male.
Fig. 31. *Campsicnemus grimshawi* new species, front femur, tibia and tarsus of male.
Fig. 32. *Campsicnemus grimshawi* new species, mid femur and tibia of male.

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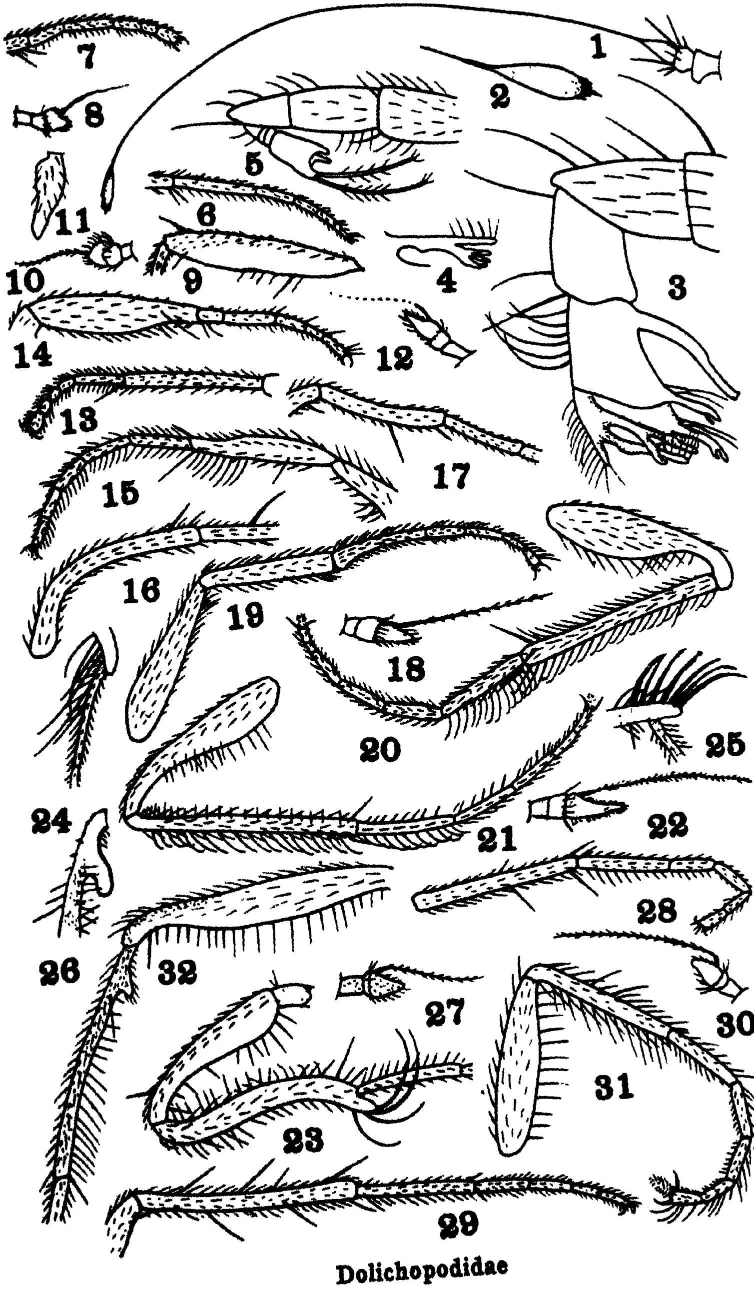


Dolichopodidae

Plate 23

Fig. 33. *Campsicnemus nigricollis* new species, antenna of male.

Fig. 34. *Campsicnemus nigricollis* new species, front coxa, femur, tibia and tarsus of male.

Fig. 35. *Campsicnemus nigricollis* new species, mid femur, tibia, and tarsus of male.

Fig. 36. *Campsicnemus nigricollis* new species, base of wing of male.

Fig. 37. *Campsicnemus obtusus* new species, antenna of male.

Fig. 38. *Campsicnemus obtusus* new species, front tibia and basitarsus of male, posterior side.

Fig. 39. *Campsicnemus obtusus* new species, mid tibia of male.

Fig. 40. *Campsicnemus octosetosus* new species, antenna of male.

Fig. 41. *Campsicnemus octosetosus* new species, front tibia and tarsus of male.

Fig. 42. *Campsicnemus octosetosus* new species, mid tibia of male.

Fig. 43. *Campsicnemus ornatus* new species, front tibia and tarsus of male.

Fig. 44. *Campsicnemus ornatus* new species, mid tibia and tarsus of male.

Fig. 45. *Campsicnemus sinuatus* new species, antenna of male.

Fig. 46. *Campsicnemus sinuatus* new species, mid femur, tibia and basitarsus of male.

Fig. 47. *Campsicnemus sinuatus* new species, mid femur and tibia of male, another view.

Fig. 48. *Campsicnemus sinuatus* new species, base of tibia of middle leg, showing double projections.

Fig. 49. *Campsicnemus spinitibia* new species, front femur, tibia and tarsus of male.

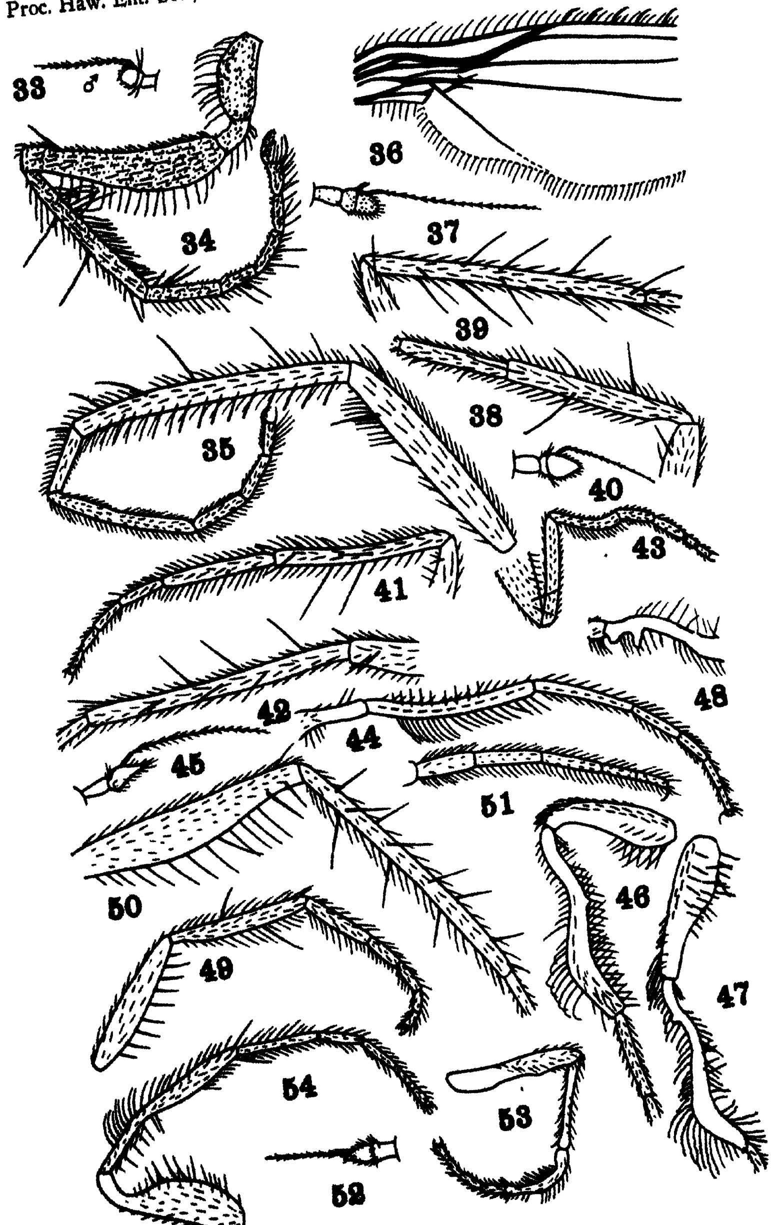
Fig. 50. *Campsicnemus spinitibia* new species, mid femur and tibia of male.

Fig. 51. *Campsicnemus spinitibia* new species, hind tarsus of male.

Fig. 52. *Campsicnemus strigosus* new species, antenna of male.

Fig. 53. *Campsicnemus strigosus* new species, front femur, tibia and tarsus of male.

Fig. 54. *Campsicnemus strigosus* new species, mid femur, tibia and tarsus of male.



Dolichopodidae

Plate 24

Fig. 55. *Campsicnemus tibialis* new species, antenna of male.

Fig. 56. *Campsicnemus tibialis* new species, front femur, tibia and tarsus of male.

Fig. 57. *Campsicnemus tibialis* new species, mid tibia and tarsus of male.

Fig. 58. *Campsicnemus tibialis* new species, hind tibia of male.

Fig. 59. *Campsicnemus tibialis* new species, antenna of female.

Fig. 60. *Campsicnemus williamsi* new species, antenna of male.

Fig. 61. *Campsicnemus williamsi* new species, front tibia and tarsus of male.

Fig. 62. *Campsicnemus williamsi* new species, mid femur and tibia of male.

Fig. 63. *Syntormon distortitarsis* new species, antenna of male.

Fig. 64. *Syntormon distortitarsis* new species, hypopygium of male.

Fig. 65. *Syntormon distortitarsis* new species, fore tarsus of male.

Fig. 66. *Syntormon distortitarsis* new species, hind tarsus of male.

Fig. 67. *Syntormon distortitarsis* new species, antenna of female.

Fig. 68. *Eurynogaster clavaticauda* new species, antenna of male.

Fig. 69. *Eurynogaster clavaticauda* new species, abdomen of male.

Fig. 70. *Eurynogaster clavaticauda* new species, middle femur and tibia of male.

Fig. 71. *Eurynogaster nitida* new species, abdomen of male.

Fig. 72. *Eurynogaster nitida* new species, mid femur and tibia of male.

Fig. 73. *Eurynogaster virida* new species, antenna of male.

Fig. 74. *Eurynogaster virida* new species, abdomen of male.

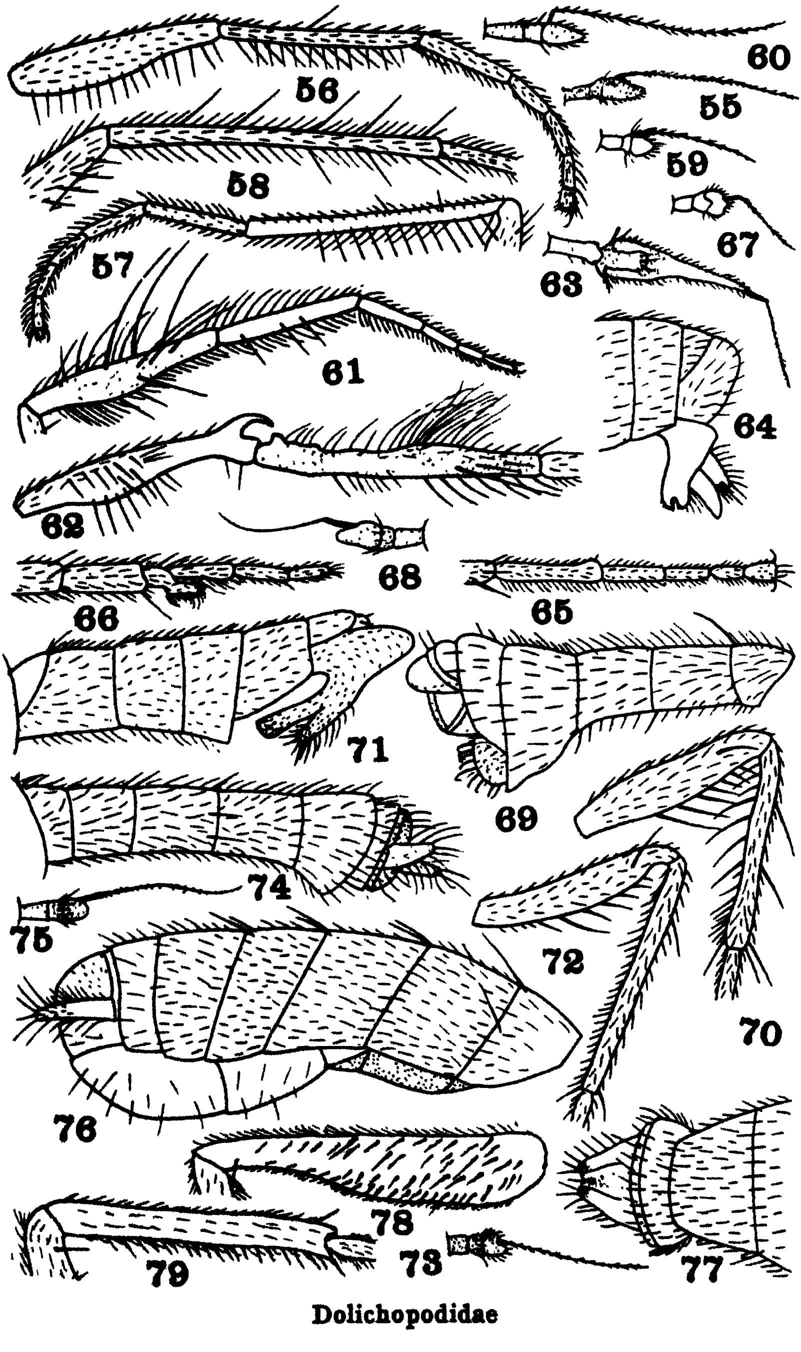
Fig. 75. *Sweziella albifacies* new species, antenna of male.

Fig. 76. *Sweziella albifacies* new species, abdomen of male, side view.

Fig. 77. *Sweziella albifacies* new species, apical segments of abdomen of male, from above.

Fig. 78. *Hydrophorus pacificus* new species, front femur of male.

Fig. 79. *Hydrophorus pacificus* new species, front tibia of male.



Dolichopodidae

Plate 25

Fig. 80. *Campsicnemus miritibialis* new species, hind femur of male, seen from above.

Fig. 81. *Campsicnemus miritibialis* new species, fore tibia and tarsus of male.

Fig. 82. *Campsicnemus miritibialis* new species, mid tibia and tarsus of male.

Fig. 83. *Campsicnemus miritibialis* new species, hind femur, tibia and tarsus of male, from the side.

Fig. 84. *Campsicnemus crinitibia* new species, antenna of male.

Fig. 85. *Campsicnemus crinitibia* new species, mid femur of male, anterior view.

Fig. 86. *Campsicnemus crinitibia* new species, mid femur and tibia of male, posterior view.

Fig. 87. *Campsicnemus crinitibia* new species, mid tibia and tarsus of male.

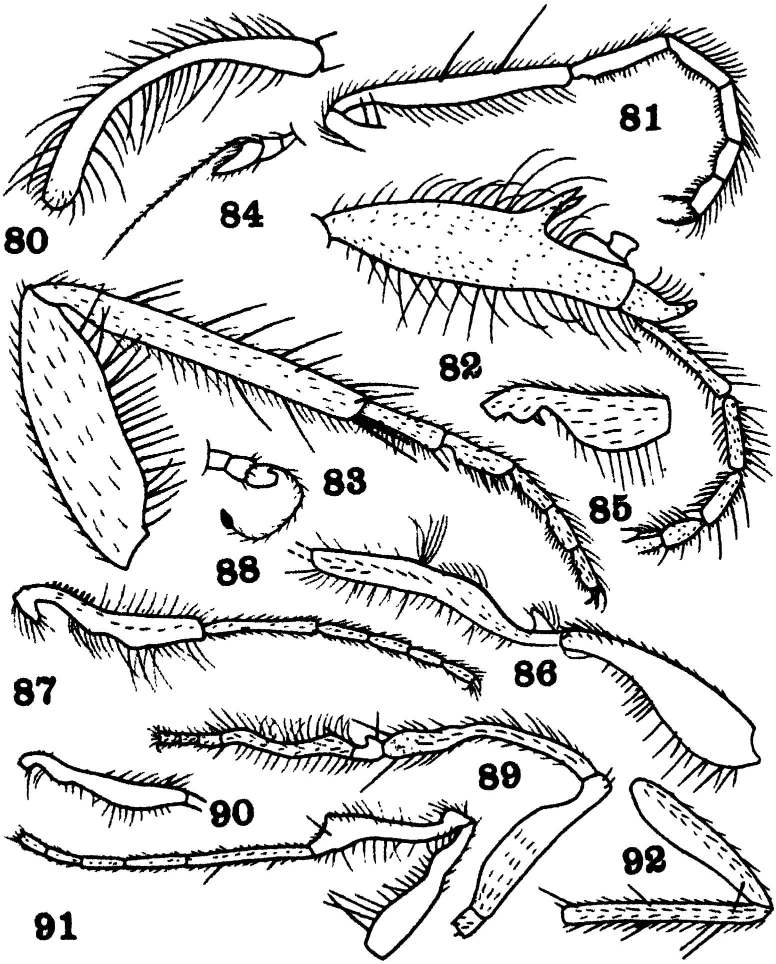
Fig. 88. *Campsicnemus nudifemorata* new species, antenna of male.

Fig. 89. *Campsicnemus nudifemorata* new species, mid femur, tibia and tarsus of male.

Fig. 90. *Campsicnemus bellulus* new species, mid tibia of male, one view.

Fig. 91. *Campsicnemus bellulus* new species, mid tibia, femur and tarsus of male.

Fig. 92. *Campsicnemus divergens* new species, mid femur and tibia of male.



Dolichopodidae

Records of Immigrant Insects for 1932

By the Editor

The occurrence in Hawaii of the following immigrant insects is recorded for the first time in this issue. Those of the list marked with an asterisk were observed for the first time in the year 1932. The other species were already known to occur here, some of them for a number of years, but they had not been identified previously, and herein their names are used for the first time in Hawaiian literature. For details of records, etc., refer to the pages given.

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PROCEEDINGS

OF THE

Hawaiian Entomological Society

VOL. VIII, No. 3 FOR THE YEAR 1933 July, 1934

JANUARY 5, 1933

The 324th regular meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., January 5, 1933, at 2:30 p.m.

Members present: Messrs. Adamson, Chapman, Chock, Ehrhorn, Fullaway, Hadden, Illingworth, Keck, Mason, Mitchell, Pemberton, Phillips, Schmidt, Smith, Rosa, Swezey, Van Zwaluwenburg and Weinrich.

Visitor: H. Darwin Kirschman.

In the absence of the Secretary-Treasurer, Dr. F. X. Williams, Mr. Swezey served as Acting-Secretary as per arrangement by Dr. Williams before leaving on a California trip. Minutes of previous meeting were read and approved, with corrections.

Mr. Swezey, as auditing committee, reported that the Treasurer's accounts had been examined and found correct.

The Acting-Secretary reported that the Executive Committee had passed favorably on the bill of $1,060.39 from the Honolulu Star-Bulletin for printing Vol. VIII, No. 1 of the "Proceedings" and had instructed the Acting-Secretary to pay $300.00 on it from the Society's funds, then hand to the Secretary of the Hawaiian Sugar Planters' Association for payment of the balance.

The Acting-Secretary reported that this had been done and that he had been informed that the bill had been paid.

On motion a vote of thanks and appreciation was extended to the Trustees of the Hawaiian Sugar Planters' Association for this generous assistance in printing the "Proceedings."

Dr. Chapman presented a letter from an official of the Century of Progress Exposition in Chicago, 1933, with suggestions for an exhibit from Hawaii showing the work and results of biological

control of insect pests here. After discussion, on motion, the following committee was appointed by the President to look into the matter: Dr. Chapman, Messrs. Fullaway, Mason and Swezey.

PAPERS

"Fire ants in dry areas", by J. S. Phillips.

NOTES AND EXHIBITIONS

Lobodiplosis pseudococci Felt.—Mr. Schmidt reported that Dr. Felt had described under this name the cecidomyid midge introduced by Mr. Fullaway in 1930 as an enemy of the pineapple mealybug. It is now known to be well established in some of the pineapple fields.

Coptotermes formosanus Shiraki.—Mr. Ehrhorn exhibited an aerial nest of *Coptotermes formosanus* which was built at the edge of a water tank in the attic of a dwelling in Manoa Valley. The nest was hanging over the edge of the tank and at times would be covered with water when tank was full. This nest really acted as an auxiliary nest for the nest which was in the ground under the house. Runways were found on the stone foundation wall for 10 feet and on a vent pipe leading into the attic and along roof timbers to the water tank. The cover of the tank was badly destroyed by the termites.

A case of a colony of the same termite on a coal barge was cited. Mr. Fullaway suggested the possibility that this termite might be carried to Samoa by U.S. Naval ships which are stationed here for a time, when a nest might become established on them before going to Pagopago to be stationed for a time. Considerable discussion followed on nesting habits of this termite.

Dr. Chapman read from correspondence regarding a request for living termite material to be sent from here to Boston to be used in some research work by a scientist working on termites. The sentiment in the discussion which followed was that it was not to be recommended.

Hunterellus hookeri Howard.—Mr. Van Zwaluwenburg reported breeding this encyrtid in December from nymphs of the dog tick, *Rhipicephalus sanguineus* Latr., collected from a dog raised in Honolulu. Originally described from Texas, bred from

R. texanus Banks (a synonym of *sanguineus*), it has since been reported from California, Mexico, Portuguese East Africa and southern India. In California an additional host is *Dermacentor parumapterus* Neumann var. *marginatus* Banks, a tick associated with jack rabbits and perhaps with dogs. Parasitized Rhipicephalus nymps eventually become swollen and discolored; the adult parasites, several per host, issue through a round opening made at the rear of the dead host. There is considerable variation in the size of the adult parasites, depending apparently upon the number of individuals to issue from a single host. Hunterellus adults were seen on a tick-infested dog both by day and by night, and exhibited no fear, running in and out of the fur in spite of close examination by the observer. An account by H. P. Wood of the life history of *H. hookeri* appears in the Journal of Economic Entomology, Vol. 4, pp. 425-431, 5 figs., 1911.

Contarinia maculipennis Felt.—Mr. Fullaway reported breeding the hibiscus bud midge from buds of pikaki, *Jasminum sambac.* Mr. Illingworth reported having had hibiscus buds from Hawaii (handed him by Harry N. Denison) with midge maggots, about 1928, but no adults were reared. That would be somewhat prior to its appearance on Oahu, where it was first noted in November, 1931.

Native Hawaiian rat.—Dr. Illingworth stated that Dr. Eskey reports finding the native rat quite prevalent on Maui, sometimes as many as 2,000 per month being secured by the trappers. He has found a new species of flea which has been named *Xenopsylla hawaiiensis* by Dr. Karl Jordan.*

Mr. Adamson mentioned that there was a native rat in the Marquesas, occurring in noninhabited islands, but has been driven out by the introduced rat in the inhabited islands.

Scelio pembertoni Timb.—Mr. Pemberton reported the recovery of this introduced grasshopper parasite from Hilo Sugar Company, Hawaii.

Eumerus sp.—Mr. Swezey exhibited a species of syrphid fly, new to the Territory and evidently of the genus Eumerus. It was taken at one of the entomological laboratory windows of the

* Novitates Zoologicae, XXXVIII, p. 264, 1932.

Experiment Station, H.S.P.A., Honolulu, on December 9, 1932, by Dr. F. X. Williams.

Galleria mellonella (Linn.).—Mr. Swezey mentioned Dr. Williams having observed a specimen of this bee moth in a downtown house in Honolulu, December 9, 1932.

Cyllene crinicornis (Chevr.).—Mr. Swezey reported this longicorn beetle working in *Acacia confusa* at Kalauao, Oahu, November 16, 1932. The young *A. confusa* trees were in an unhealthy or dying condition due to long drought and poor soil. One beetle was collected on bark, and a good many branches found to contain nearly full-grown larvae. Some branches were cut and taken to the laboratory for rearing. Beetles issued at intervals from December 6 to January 4. One beetle also reared from a branch of Haematoxylon tree, and branches of *Acacia arabica* were found containing larvae. In all cases the infested branches of the various trees were in an unhealthy condition, and apparently the infestation by beetle larvae was secondary, the same as when algaroba trees or wood is attacked by them. The full-grown larva bored a hole through the bark for exit hole, then retreated for 1 to 2 inches into the burrow and plugged up the latter with chips and wood fibers about ½-inch from the exit hole, thus a pupal cell is formed in which the larva transforms to pupa, then to adult beetle.

Three adults of the monkey-pod borer *Xystrocera globosa* (Oliv.) were collected on the bark of the *Acacia confusa* trees, and it was thought that they also were probably infesting the trees, but none reared from the infested branches brought in.

Mesolelaps cyaneiventris Ashm.—A specimen of this miscogasterid was exhibited by Mr. Swezey. He had collected it November 6, 1932, in beating on Coprosma on Puu Kaua, Waianae Mountains, Oahu. This species was collected by Dr. Perkins at Olaa, Kilauea, and Kona, Hawaii, and has not been recorded since.

Agromyza virens Loew.—Mr. Swezey reported this Agromyza as having bred from a small Wilkesia plant which he had brought down from Kokee, Kauai, in July, 1932. The maggots had bored in the tender stem and killed the plant.

Marquesan Orthoptera.—Mr. Adamson, commenting on Hebard's paper on Orthoptera in Marquesas called to attention the

great dissimilarity of the fauna as compared with Hawaii. Subfamilies with endemic species are different in each group of islands.

FEBRUARY 2, 1933

The 325th regular meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., February 2, 1933, at 2:30 p.m.

Members present: Messrs. Bryan, Carter, Chapman, Ehrhorn, Fullaway, Hadden, Illingworth, Keck, Marlowe, Mason, McBride, Mitchell, Pemberton, Rosa, Schmidt, Smith, Swezey, and Van Zwaluwenburg.

As Dr. Williams, the Secretary, was still away on a vacation trip to California, Mr. Swezey continued as Acting-Secretary. Minutes of the previous meeting were read and approved.

Dr. Chapman reported progress of the committee on the exhibition of biological control of insects for the Chicago Century of Progress Exhibition.

Mr. Pemberton read an invitation for a representative of the Society to attend the Centenary Anniversary in May of the Entomological Society of London. Mr. Bryan suggested that Dr. Perkins be asked to represent the Society, if possible for him to attend.

The Acting-Secretary passed around a photograph of the late Dr. Kieffer which had been received. He also read a communication from Mr. Sternitzky of San Francisco, announcing collecting trips to Mexico in 1933, and offering to make specific collections on order.

Dr. Carter reported on his attendance at the 5th International Entomological Congress in Paris, July, 1932. He gave incidents of the meeting and of those attending, and reviewed a number of the important papers. He specially dwelt on papers dealing with virus transmission and symbionts. Went to Dr. Buchner's laboratory at Breslau, where a great deal of work is being done with symbionts. Visited some other institutions working on virus, etc. Also told of work being done at Rothamstead Experiment Station in England. Found a good system of Extension Agents in vogue for reaching the farming communities. On return trip, spent 19 days

in Jamaica and three months in Guatemala. Will report on this at next meeting, with pictures which are not yet ready for exhibition.

PAPERS

"**The Immunity of Pseudococcus brevipes** (Ckll.) **to Parasitism by Coccophagus gurneyi** Compere," by Carl T. Schmidt.

NOTES AND EXHIBITIONS

Coptotermes formosanus Shiraki.—Mr. Ehrhorn exhibited pieces of redwood (from a 30-year-old building) which had been somewhat eaten by *Coptotermes formosanus* and *Cryptotermes piceatus*. Heretofore redwood has been said to be free from termite attack.

Followed by considerable discussion on termite resistant woods, poisoned canec, etc.

**Rhyncogonus* n. sp.—A fine large specimen of this weevil was exhibited by Mr. Swezey. It was captured September 25, 1932, by Mr. Welch of the Bishop Museum while collecting shells in the upper part of Lualualei Valley in the Waianae Mts., Oahu. The exact locality was at 1600 feet elevation in Halona Valley (a branch of Lualualei) and is the fourth gulch southwest of Pohakea Pass. The beetle was on an unidentified shrub or small tree. The beetle is black, with a longitudinal stripe of white scales on each elytron and some other white patches, and is quite distinct from any known species so far collected. It is larger than most species.

Campodea sp.—Mr. Swezey exhibited a specimen of this primitive thysanuran which he captured January 29, 1933, in a rotten koa log on Kahauiki Ridge about 1000 feet elevation. Mention is made in the "Fauna Hawaiiensis" of the occurrence of this insect in Hawaii, but no record of the species is made. It is a delicate insect, and seldom collected.

Crossotarsus externedentatus Fairm.—Specimens of this scolytid were exhibited by Mr. Swezey, who had collected them from the trunk of a *Cassia nodosa* tree at Miss Yoder's on Makiki Street, Honolulu, February 1, 1933. Scores of the beetles were

* *Rhyncogonus welchii* Perkins. Proc. Haw. Ent. Soc., VIII, No. 2, p. 269, 1933.

boring into the bark on the trunk and branches of this tree, which appeared to be in a healthy condition. The beetles usually attack unhealthy or dying trees, or dying branches. It has been specially recorded on avocado, and also previously recorded on kukui, Elaeocarpus, Maba, Eugenia, Syzygium, Eucalyptus and Albizzia.

Heteropoda regia (Fabr.).—Dr. Chapman inquired as to the occurrence of tarantula spiders in Hawaii, as there was a court case against a pineapple canning company on account of a "tarantula" being found in a can of pineapples. A member replied that tarantulas do not occur in Hawaii, and that the "tarantula" found in a can of pineapples must have been the common large house spider (*Heteropoda regia*), which is not related to tarantula.

Leucaspis cockerelli Green.—Mr. Pemberton reported this scale insect having been found on orchids in Hilo, Hawaii, January, 1933, by L. W. Bryan, and that Dr. Lyon has found it on orchids in Honolulu also. This pest has not been recorded previously in Hawaii. The material was determined by Mr. Whitney, who states that the species has been recorded on Pritchardia and Dracaena in Ceylon.

Habrolepis sp.—A specimen was exhibited by Mr. Fullaway which runs to this genus, which has not previously been recorded in Hawaii. The specimen was collected on weeds at Pearl City by Mr. Chock.

Thripoctenus sp.—Mr. Fullaway exhibited a slide mount of this thrips parasite which he had found dead on a carnation leaf, January, 1933.

MARCH 2, 1933

The 326th regular meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., March 2, 1933, at 2:30 p.m.

Members present: Messrs. Bryan, Ehrhorn, Fullaway, Hadden, Illingworth, Ito, Keck, Krauss, Marlowe, Mason, McBride, Mitchell, Pemberton, Rosa, Schmidt, Swezey, Van Zwaluwenburg, and Williams.

Visitors: C. J. Joubert, H. Darwin Kirschman.

President Pemberton called the meeting to order. The minutes of the previous meeting were read and approved with corrections.

Messrs. Fullaway, Swezey, and Pemberton discussed arrangements for getting up and financing exhibits on biological control of insects for the Chicago Century of Progress Exposition.

President Pemberton stated that he had written to the Secretary of the Entomological Society of London recommending that Dr. R. C. L. Perkins represent the Hawaiian Entomological Society at the Centenary of the Entomological Society of London. He also wrote to Dr. Perkins in this regard.

President Pemberton then introduced Mr. C. J. Joubert, Lecturer-Research Officer, College of Agriculture, Stellenbosch-Elsenburg, South Africa, who is spending a short time in Hawaii and is interested in the biological control of insects in these Islands.

Mr. Joubert touched briefly on several of the more important entomological problems in South Africa. He stated that fruit-fly control in South Africa consisted chiefly of syringing (not spraying) poison bait on trees, or in districts of summer rains, of using a trap or pot bait, a good mixture for this second method consisting of pollard, treacle, borax and sodium arsenate. The codlin moth is fought by means of arsenical spray and flourine compounds—acid oil emulsions were added to remove arsenic from the fruits subsequently. The codlin moth also bad on apricots, peaches, and plums, particularly where these are in or near an apple orchard. Among indigenous pests is the false codlin moth that attacks citrus, the larva boring into the fruit. Arsenate of lead spray renders the citrus fruits insipid and so cannot be used here. Picking and destroying the infested fruit is recommended. Citrus mealybugs present; *Pseudococcus nauhanae* and *maritimus* are bad on pears, the sooty fungus following their attack lowers the value of the fruit and is hard to remove. *P. maritimus* is a major pest on export grapes.

There is much for the entomologist to do in Mr. Joubert's district as the land area is large and the scientific staff small.

Mr. Bryan introduced Mr. H. Darwin Kirschman, local representative of Ward's Natural Science Establishment of Rochester, New York, and E. H. Sargent and Company of Chicago, on chemical supplies. Mr. Kirschman responded to the introduction with a few words.

PAPERS

Mr. F. C. Hadden presented a paper entitled: **"Cicindelidae in the Collection of the Experiment Station of the Hawaiian Sugar Planters' Association, and in the collection of Fred C. Hadden."** As a matter of information Mr. Swezey stated that no Cicindela beetles are found in the Hawaiian Islands.

NOTES AND EXHIBITIONS

Rhyncogonus saltus Perkins.—Living specimens of this beetle were exhibited by Mr. Swezey which were collected by him on a native species of Bidens on Puu Hapapa, Waianae Mts., Feb. 5, 1933, at an elevation of 2500 feet. It is about a quarter of a mile from where the original colony was discovered near Kolekole Pass, May 9, 1920. The present colony is near the crest of the main ridge and limited to about a hundred feet along the trail. Much sweeping was done on the Bidens, which occurred abundantly along the trail below and also beyond, but no beetles were captured except in the small area.

Anthonomus eugenii Cano.—Mr. Fullaway reported the following on the pepper weevil: Originally in Mexico, now in New Mexico, Arizona and So. California. Infests peppers, also can survive in Solanums (Cestrum). Discovered in Honolulu on Feb. 24, 1933, in a Cummings School garden, Kaimuki. Found since in many places: Honolulu and at Waipahu and Pearl City. Infests bell peppers and chili peppers. Eggs said to be laid in blossoms; larva mostly in small or not fully formed fruits, causes dropping; often several in a fruit; pupates in a roughly formed cell of frass inside fruit. The adult can fly.

Cremastus hymeniae Vier.—A specimen was exhibited by Mr. Swezey which had freshly issued from cocoon. Its host was a small caterpillar found on leaf of native violet on Puu Kanehoa, Waianae Mts., Feb. 5, 1933. The host* will not be known until the moth issues from chrysalis formed by another caterpillar from the same plant. A third caterpillar had died when about half grown

* *Phlyctaenia violae* Swezey. Proc. Haw. Ent. Soc., VIII, No. 2, p. 299, 1933.

and was found to contain a parasite larva which was probably Cremastus.

Rhyncogonus simplex Perkins.—A living beetle was exhibited by Mr. Swezey, collected by him, Feb. 22, 1933, under dried cow dung at the same place on Koko Head where discovered by Mr. Hadden, Jan. 11, 1928, and collected by Mr. Swezey, Nov. 27, 1930. This indicates that the isolated colony there is keeping up its existence.

Symphostethus pacificus Fleutiaux.—Mr. Van Zwaluwenburg exhibited a metatype specimen (from the Giffard collection) of this elaterid beetle from Guadalcanar, Solomon Islands, which had been named by Dr. Edmond Fleutiaux of Nogent-sur-Marne, France. When Dr. Fleutiaux had the specimen he thought it might be a variety of *S. collaris* Schwartz, described from New Guinea. More recently he writes that after comparison with Schwarz's type he has named the species *S. pacificus*, the type being a specimen in the Fleutiaux collection, from Bougainville, Solomon Islands. The description appears in this issue of the Proceedings, p. 473.

Cotype of Neodiploconus nigripes Fleutiaux.—Through the courtesy of Mr. Hadden, a cotype of this Philippine elaterid species, described in the Philippine Journal of Science, Vol. 49 (4), p. 568, Dec., 1932, has been deposited in the type collection of the Hawaiian Entomological Society.

Tenodera angustipennis Sauss.—Dr. Williams referred to two articles in the Entomological News for January, 1933, on two Oriental Mantids, *Tenodera angustipennis* and *T. sinensis*. Judging from the form of the egg-masses of these two insects, it is evident that our large common mantid in Hawaii is not *T. sinensis*, as has been so long considered, but *T. angustipennis*, its close relative.

Dr. Williams also showed an excellently written handbook entitled "What Butterfly is That" or a Guide to the Butterflies of Australia, G. A. Waterhouse. The plates, mostly in color, by N. W. Cayley, are very excellent. It was sent to the Hawaiian Entomological Society for review, by the publishers, Angus and Robertson of Sydney, Australia.

APRIL 6, 1933

The 327th regular meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., April 6, 1933, at 2:30 p.m.

Members present: Messrs. Adamson, Bryan, Ehrhorn, Fullaway, Hadden, Illingworth, Keck, Krauss, Mason, Marlowe, McBride, Mitchell, Mumford, Pemberton, Riley, Rosa, Solander, Schmidt, Smith, Swezey, Van Zwaluwenburg, Weinrich, Wilder, Williams and Miss Suehiro.

Visitor: Mr. H. D. Kirschman.

President Pemberton called the meeting to order. The minutes of the preceding meeting were read and approved with corrections.

Committee on Exhibits for the Chicago Century of Progress Exposition: Mr. Swezey reported that a number of cases of insects showing biological control were being prepared by Mr. Fullaway and himself, and according to instructions were to be sent C.O.D.

Miss Amy Suehiro was elected to membership.

Mr. Mumford mentioned that Prof. Esaki of Japan is making a card index of entomologists who collected and studied in Japan. He gave a questionnaire to the Society for the entomologists concerned to fill out. On behalf of Dr. Hachiro Yuasa, Kyoto Imperial University, Mr. Mumford donated the book Iconographia Insectorum Japonicorum to the Hawaiian Entomological Society. The President then suggested that the Secretary write and thank Dr. Yuasa for his fine gift.

Dr. Gerrit P. Wilder, being called upon, gave an interesting talk on his work in the Tuamotu Archipelago and chiefly in Makatea Island, 126 miles from Tahiti. The island is valuable for the phosphate which is exported. The vegetation is scant there. He exhibited boxes of insects mounted and labeled by Miss Suehiro.

PAPERS

Mr. Swezey read a paper entitled: **"The Distribution of the genus Rhyncogonus on Oahu (Col.-Curculionidae)."**

Mr. Bryan read a review of an Australian Butterfly book by Dr. Waterhouse.

Toxomerus marginatus (Say).—A specimen of this syrphid fly was exhibited by Mr. Swezey. Several specimens had been handed him by Mr. K. O. Moe. They were collected March 20, 1933, in Kalihi, Oahu, at flowers. It is the first record of this new immigrant fly on Oahu. It had been taken first by Mr. Swezey at Kokee, Kauai, in June, 1932.

Orothreptes callithrix Perkins.—Mr. Swezey exhibited a specimen of this cossonid weevil collected by him from *Pisonia sandwicensis*, in Halona Valley, Waianae Mts., March 12, 1933. It is a very rare beetle, first collected by Dr. Perkins in Kona, Hawaii (a single specimen) and later on Mt. Tantalus, Oahu, by Dr. Perkins and Mr. Giffard.

New psyllid.—Mr. Swezey exhibited specimens and photographs of a psyllid reared from galls on under side of leaves of *Pisonia sandwicensis*, collected in Halona Valley, Waianae Mts., March 12, 1933. From a bunch of leaves brought in, 89 of the psyllids had issued. As many as 5 nymphs were found in a single gall.

Litomastix floridana (Ashm.).—Mr. Swezey reported capturing two specimens of this Plusia parasite on a taro leaf in Halona Valley, Waianae Mts., March 12, 1933. He exhibited, also, a *Plusia chalcites* caterpillar affected by this parasite, which was collected by Mr. Van Zwaluwenburg on weeds in Field 42, Oahu Sugar Company, Ltd. (near Kipapa Gulch), April 3, 1933. The Halona record is the farthest on Oahu from Honolulu that the parasite has been taken. This indicates the parasite to be widely spread already.

Atractomorpha ambigua Bolivar.—Mr. Pemberton reported that two specimens of this grasshopper were received from Mr. W. L. S. Williams, Manager, Waiakea Mill Company, on March 17, 1933. This is the first record of its occurrence on the Island of Hawaii.

Promylaea pyropa Meyrick.—Dr. Williams exhibited a specimen of this rare pyrausted moth which he had taken feeding at the

flowers of Hoya (Asclepiadaceae) at Woodlawn, Honolulu, in the late afternoon of March 14, 1933.

Many years ago Mr. O. H. Swezey reared this insect from caterpillars that mined the leaves of *Peperomia pachyphylla* (Proc. Haw. Ent. Soc., II, p. 221, 1913).

Mr. Keck spoke of the amicable relations between two queen bees in one of his hives and asked if any of the entomologists had noticed a similar condition. The queens had been together for 3 weeks.

Coptotermes formosanus Shiraki.—Mr. Ehrhorn spoke of a Nothopanax hedge being attacked by this termite.

Lagocheirus obsoletus Thoms.—Mr. Swezey mentioned the numerous very large, though usual, emergence holes made in dead Kukui (Aleurites) trees in Kamokuiki Valley in the Waianae Mts., Oahu, by Lagocheirus grubs, which he had recently observed.

MAY 4, 1933

The 328th regular meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., on May 4, 1933, at 2:30 p.m.

Members present: Messrs. Adamson, Bryan, Ehrhorn, Fullaway, Illingworth, Keck, Krauss, Marlowe, Mason, McBride, Pemberton, Rosa, Schmidt, Smith, Swezey, Van Zwaluwenburg, Wilder, Williams, and Miss Suehiro.

President Pemberton called the meeting to order. The minutes of the preceding meeting were read and approved with corrections.

Committee on Exhibits for the Chicago Century of Progress Exposition: Mr. Swezey reported that the cases of insects illustrating biological control had been sent off in late April.

A communication was read from Prof. Esaki of the Kyushu Imperial University, Fukuoka, Japan, in which he requested data from entomologists who had collected or studied in Japan.

Mr. E. P. Mumford, in a communication, expressed his regret at his inability to attend, as often as he wished, the meetings of the Hawaiian Entomological Society.

Through a communication from Mr. J. K. Butler to Mr. H. P. Agee, Director of the Experiment Station, H.S.P.A., a "wire"

was received from Dr. R. C. L. Perkins saying he would be pleased to act as delegate at the Centenary of the Entomological Society of London.

The Secretary read a letter of thanks from the Hawaiian Entomological Society to Dr. H. Yuasa for the copy of Iconographia Insectorum Japonicorum.

Mr. O. H. Swezey stated that he had received a communication from Dr. R. J. Tillyard saying that he would pass through Honolulu on May 12.

Mr. Swezey mentioned that Dr. R. C. L. Perkins had sent him some of his diary notes in the Hawaiian Islands.

PAPERS

Mr. R. H. Van Zwaluwenburg presented a paper from Dr. F. Silvestri entitled: **"Description of a new species of Thysanura from the Hawaiian Islands."**

Mr. Van Zwaluwenburg also presented a paper from Dr. E. Fleutiaux entitled: **"Description d'un Elateride nouveau."**

Mr. O. H. Swezey read a paper entitled: **"Insects from Bermuda Grass, Kawela Bay, Oahu, April 23, 1933."**

NOTES AND EXHIBITIONS

Plusiocampa (*Microcampa*) *perkinsi* Silvestri.—Mr. Van Zwaluwenburg made a note concerning this thysanurid, described on page 519. It is a truly subterranean insect, so far known only from the island of Oahu. In studies of a field of growing cane it averaged 21 per surface square foot (to a depth of 9 inches), comprising over one per cent of all the animal life tabulated. Of the number found in the upper nine inches, over half were between the 3 and 7 inch levels. In soil in which cane was growing, it was over 20 times more abundant than in fallow cane soil. It is erroneously referred to in the Handbook of Sugar Cane Insects (p. 350) as Campodea, and the figure given (Fig. 179) is of a similar but not congeneric insect.

Scelio pembertoni Timb.—Mr. J. S. Rosa recorded the recovery of *Scelio pembertoni,* parasitic in the egg of the Oxya grasshopper, from eggs that had been exposed in the field in April, 1933, at Waialua, Oahu.

Triatoma rubrofasciata (Lap.).—Mr. D. T. Fullaway exhibited this reduviid bug, rarely taken here. It bites severely. One was brought in from Kaimuki by a schoolboy. Mr. Bryan mentioned that occasionally the bug was brought into the Entomology Laboratory by University students.

Hydrovatus confertus Sharp.—Dr. Williams exhibited an enlarged photograph of the crop and gizzard of this little water beetle. Through the wall of the crop could be seen an almost perfect copepod crustacean which the beetle had swallowed.

Sarcophaga barbata Thoms.—Mr. Swezey recorded having reared this fly from dog excrement found containing numerous maggots.

Pterolophia camura Newman.—A specimen of this cerambycid beetle was exhibited by Mr. Swezey, collected by him April 15, in house. It is a somewhat recent immigrant, having been first collected by Kusche in Honolulu, May 7, 1919; again by Rosa in Nuuanu Valley, March 18, 1930, and July, 1932; and at Waikiki by Bianchi, July 10, 1932. The identification has only now been made by comparison with specimens brought back by Hadden from the Philippines and determined by Fisher, Washington, D. C.

Aphidencyrtus aphidivorus (Mayr).—Attention was called by Mr. Swezey to the synonomy of this hyperparasite of aphids given by Gahan in Proc. U. S. Nat. Mus., 77, Art. 8, p. 6, 1931. This is the insect heretofore known in Hawaii as *Aphidencyrtus schizoneurae* (Ashm.).

Melittobia hawaiiensis Perk.—Mr. Schmidt reported that a new host record for this parasite was found when a large number of these parasites were reared from a nest of *Polistes* sp. from the Makiki district of Honolulu. This was believed to be a case of true parasitism since the contents of the cell were examined carefully on the chance that some other insect may have appropriated the nest for its own use. No indication was seen that the host was not Polistes. Both males and females were present. The total number of parasites in the cell was somewhat over two hundred. The exact number was not determined because the cell had been pierced at the time it was found so that some may have escaped.

Mr. Pemberton exhibited two Hawaiian-born toads (*Bufo marinus*) of good size.

Mr. Pemberton exhibited also some scarabeid beetles and scoliid wasps parasitic on scarabeid grubs, sent in by Mr. F. Bianchi from Guatemala, where Mr. Bianchi is rearing and studying these insects.

JUNE 1, 1933

The 329th regular meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., on June 1, 1933, at 2:30 p.m.

Members present: Messrs. Adamson, Carter, Ehrhorn, Illingworth, Krauss, Marlowe, Mason, McBride, Mitchell, Pemberton, Van Zwaluwenburg, and Williams.

Visitor: H. D. Kirschman.

President Pemberton called the meeting to order. The minutes of the preceding meeting were read and approved.

The Secretary read a communication from D. L. Crawford, President of the University of Hawaii, to Mr. Swezey and accompanying some notes by T. C. Lawrence, on **"The feeding habits of the centipede Scolopendra subspinipes."**

Dr. W. Carter spoke of the difficulty of rearing the Guatemalan drosophilid fly enemy of the pineapple mealybug. He also referred to the symbiotic organisms in the mycetoms of *Pseudococcus brevipes* (Ckll.), which subject was discussed at length.

JULY 6, 1933

The 330th regular meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., July 6, 1933.

Members present: Messrs. Adamson, Bryan, Ehrhorn, Marlowe, McBride, Pemberton, Swezey, Van Zwaluwenburg, and Williams.

President Pemberton called the meeting to order at 2:35 p.m. The minutes of the preceding meeting were approved as read.

Upon request, Mr. O. H. Swezey gave an interesting synopsis

of the Pacific Science Congress meeting held June 1-14 at Victoria, Vancouver, B. C., which he had attended.

NOTES AND EXHIBITIONS

A Sminthurid new to Hawaii.—Mr. Van Zwaluwenburg stated that in a recent letter from Dr. J. W. Folsom, he reports finding, among some soil collembolans from Honolulu, a few specimens of a minute *Megalothorax,* probably *minimus* Willem.* This genus is an addition to the local fauna.

†*Ponerine ants new to the Hawaiian Islands.*—Mr. Van Zwaluwenburg stated that a recent letter from Dr. W. M. Wheeler reports the finding of two new species of ants among the soil collections made some years ago during a study of the "microgenton" of local sugar cane fields. They are small, subterranean, eyeless species belonging to the genus Cryptopone, a genus new to the Islands, and one which, according to Forel, is characteristic of the Indo-Malayan region. One of the species came from Honolulu, while the other was found at three widely separated localities on Oahu, as well as on central Maui.

Stenotrupis filum Fairm.—Mr. Swezey reported having recently received the identification by Dr. Marshall of this small cossonid beetle. It has been known for some time on Oahu, the first specimens having been obtained as early as April 23, 1908, at Waialua Agricultural Co., where they were found on sugar cane beneath the leafsheath. Similarly, it was collected at Ewa Plantation, March 29, 1932. A specimen was obtained, Dec. 17, 1919, on bark of an algaroba tree at Waipio. The larval habits have not been discovered yet. Dr. Marshall stated that this beetle was described from Tahiti. It is the same beetle that was reported on by Mr. Swezey at the October 6, 1932, meeting as having been found by Mr. Whitney in quarantine inspection of coconuts from Samoa, August 11, 1932.

Eumerus sp.—Mr. Pemberton exhibited a new immigrant syrphid fly with conspicuous white tarsi on posterior pair of legs. Taken at H.S.P.A. Experiment Station grounds June 10, 1933. Apparently new to Hawaii.

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* Ann. Soc. Ent. Belgique, 44, p. 7, 1900.

† *Pseudocryptopone swaluwenburgi* and *P. swezeyi* Wheeler, Am. Mus. Novitates, No. 672, pp. 14 and 16, figs. 5 and 6, 1933.

Pteroporus subtruncatus Fairm.—Mr. Pemberton exhibited a ginger weevil reared from a bulb of lily, *Hemerocallis* sp., collected by Dr. H. L. Lyon on June 27, 1933, in grounds of J. W. Waldron, Nuuanu Valley, Honolulu. Not seen since 1918, when it was collected from ginger at Sherman residence Nuuanu Valley.

Latrodectes mactans (Fabr.).—Mr. Pemberton reported an hourglass spider (♀) collected by Mr. D. M. L. Forbes at Kawaihae, Hawaii, among rocks on beach June 1, 1933. This is the first record of its occurrence on the island of Hawaii.

Sceliphron caementarium (Drury).—Mr. Pemberton reported that this wasp was found storing its cells with mostly hourglass spiders *Latrodectes mactans* (Fabr.) at the Dowsett beach residence at Waianae, Oahu, on June 22, 1933. The contents of several mud nests sent to the Experiment Station consisted of 24 female and 13 male Latrodectes and 2 spiders of another species.

The Enemies of Tanytarsus (Diptera-Chironomidae).—Dr. Williams read notes as follows: This fragile little green midge, of which there may be more than one species here, may be commonly observed as swarms consisting of males, lazily hovering over the waters of mountain streams. It seems certain that adult dragonflies and damselflies feed regularly on these midges. In the water where the early life of Tanytarsus is passed they are beset with even more enemies. The eggs are laid in the water while the tube-building writhing larvae dwell at the bottom of poollets or among green algae there. A study of this chironomid in certain little mountain pools back of Honolulu showed that the fresh-water gobies preyed extensively on the larvae; the nymphs of Odonata, particularly Agrion, no doubt Nesogonia as well, ate large numbers, while at the critical time of eclosion of the adult—i.e., when the Tanytarsus pupa swims, or wriggles to the surface, freely or through a bed of algae—gangs of Microvelia, the tiny water-striding bug, pounce upon the pupa as it gains the surface, pierce it with their beaks, and suck the juices; they attack the tender fly in the act of issuing—a matter of perhaps 30 seconds—and even capture the fly as it takes wing. Many captives of Tanytarsus by groups of these foraging bugs were observed, and even small tipulid pupae of semiaquatic habit suffered likewise. In addition, a few

larvae of dolichopodid flies, well known to be predacious, were found in the green algae accumulated on the quiet portion of pools.

Hylemyia cilicrura (Rondani).—A recent report that the cabbage maggot was present at Waimea, Hawaii, proved, upon investigation of material sent in by Messrs. Pemberton, Whitney, and Bryan, to be a case of mistaken identity, the fly being the allied seed-corn maggot. The cabbage maggot, *Hyleymia brassicae* (Bouché) is not known to be present in the Hawaiian Islands.

Coptotermes formosanus Shiraki.—Mr. Ehrhorn spoke of an afternoon flight of the ground-inhabiting termite, *Coptotermes formosanus,* in Honolulu.

AUGUST 3, 1933

The 331st regular meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., on August 3, 1933, at 2:30 p.m.

Members present: Messrs. Bryan, Illingworth, Marlowe, Mason, McBride, Pemberton, Swezey, Van Zwaluwenburg, and Williams.

Visitor: H. Darwin Kirschman.

President Pemberton called the meeting to order. The minutes of the preceding meeting were approved as read.

President Pemberton exhibited and commented on the appropriately worded and neatly printed address of welcome from the Society's delegate, Dr. R. C. L. Perkins to the Entomological Society of London on behalf of its Centenary Celebration.

The Secretary stated that 29 out of a possible 37 reply cards had been received from Sugar Plantation Managers who desired—as offered by the Society—a set of its Proceedings.

Mr. E. H. Bryan gave an interesting review of a worth-while book, Carter's "Gulliver in the Bush." Mr. Carter is a Coleopterist of many years' experience in Australia.

NOTES AND EXHIBITION OF LOCAL MATERIAL

Diachasma tryoni Silv.—Mr. Swezey reported rearing two of this parasite from *Ceratitis capitata* Wied. in peaches collected in Kukuiala Valley, Waianae Mts., July 16, 1933.

Protura (Myrientomata).—Mr. Van Zwaluwenburg exhibited a slide mount of this rare insect collected from soil from a cane field near Honolulu in July, a new record for the Hawaiian Islands. The Protura are minute whitish animals characterized as follows: entognathous piercing mouthparts, antennae and compound eyes wanting, and abdomen 12-segmented with the first three segments each with a pair of small appendages. They have the habit of walking with the forelegs extended in front of the head, probably to function as tactile organs. They are world-wide in distribution. Their systematic position is largely a matter of opinion, according to Imms (General Textbook of Entomology, pp. 210-213, 1925); Berlese and Comstock held that they formed a class of their own (Myrientomata) while Silvestri and Borner place them among the Insecta. Hawaiian specimens were sent to Dr. Silvestri, who will report on them later.

Aleurodidae (?) from the soil.—Slides were exhibited of larvae and a pupa of what appears to be an aleurodid, collected in a Berlese funnel from soil from a cane field near Honolulu in July. The material came from a depth of three to six inches below the surface, and is believed to be truly subterranean, being taken several yards away from any weeds to which they might have been attached; had they been dislodged and fallen from cane foliage directly above the spot where they were taken it is reasonable to suppose that the species would have been recorded on cane before now. Mr. Pemberton collected the same insect at Honokaa, Hawaii, in February, 1928, on decaying cane tissue underground.

An Ichneumonid apparently new to Hawaii.—A male wasp was exhibited taken on a window pane at the H.S.P.A. Station on July 26, 1933, which has been determined by Dr. Williams as near Exochus? (subfamily Tryphoninae).

Mesovelia mulsanti White.—Dr. Williams exhibited specimens of this small predacious bug which frequents the algae mats in a plantation reservoir at Waipio, Oahu. It seems to be *M. mulsanti*, described from the Amazons and appears to be the only American species. That species inserts its eggs in plant tissues—hence could be easily transported here. In the laboratory it preyed upon *Merragata hebroides* White, a common, much smaller water-running

bug here. It is the first record of this insect in the Hawaiian Islands.

Anagrus sp., *damselfly egg-parasite*.—Dr. Williams recorded the hatching of a damselfly (*Agrion* sp.) from eggs which were very numerous in leaves of *Commelina nudiflora* collected by the stream in Hering Valley. An undetermined species of a new mymarid (*Anagrus* sp.) issued from many of the eggs. It is the same parasite that Mr. Swezey bred from eggs in leaves of *Ipomoea bona-nox* collected in Haleauau Valley, September 14, 1930. At that time nothing hatched from the eggs except the parasites, and the eggs and method of oviposition were unrecognized, so the host of the parasite was a mystery. These are the first records of parasitism of damselfly eggs in Hawaii. Probably this Anagrus should be considered an endemic species.

Tromatobia rufopectus (Cress.).—Mr. Pemberton exhibited an egg-sac of the spider *Argiope avara* Thor. which he had found on sugar cane at Mountain View, Hawaii, July 28, 1933. It had been parasitized by the ichneumonid *Tromatobia rufopectus*, a dozen or more cocoons of this parasite being closely packed in the egg-sac. The most of these cocoons were in turn parasitized by an entedonine later determined as *Pleurotropis wilderi* (How.). This is the first record of the latter parasite from the Island of Hawaii and as a secondary parasite of *Tromatobia rufopectus* here.

Fig-wasps established on Kauai.—Mr. Pemberton reported that Dr. H. L. Lyon had found during the latter part of July, 1933, on the island of Kauai, fruits of *Ficus rubiginosa* and *Ficus macrophylla* containing their respective pollinating agaonids: *Pleistodontes imperialis* Saund. and *Pleistodontes froggatti* Mayr. They had reached Kauai from Oahu without assistance.

SEPTEMBER 7, 1933

The 332nd regular meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., on September 7, 1933, at 2:30 p.m.

Members present: Messrs. Bryan, Ehrhorn, Fullaway, Hadden, Illingworth, Krauss, Mason, Marlowe, McBride, Pemberton, Rosa,

Schmidt, Smith, Solander, Swezey, Van Zwaluwenburg, Weinrich, Williams and Miss Suehiro.

Visitor: H. D. Kirschman.

President Pemberton called the meeting to order. The minutes of the previous meeting were read and approved with corrections.

PAPERS

Mr. O. H. Swezey presented a paper by Mr. Dudley Moulton entitled **"New Thysanoptera of the Hawaiian Islands."**

Mr. R. H. Van Zwaluwenburg presented two papers by Dr. E. Fleutiaux entitled "**Quatre Elatérides Nouveaux**" and "**Elatérides Nouveaux des Iles Philippines.**"

NOTES AND EXHIBITIONS

Diachus auratus (Fabr.).—Dr. Illingworth reported this species taken from the foliage of Calliopsis plants growing in his yard at Kaimuki. This beetle is evidently an accidental introduction from the United States. It has been reported from time to time in our "Proceedings." The earliest capture is a specimen in the collection of the Board of Agriculture taken by Kotinsky, at Waianae in 1909. (Proc. Haw. Ent. Soc. III, 288.)

Haplothrips usitatus (Bagn.).—Dr. Illingworth exhibited diseased specimens of Calliopsis taken in his garden at Kaimuki. The terminal buds were very badly distorted, evidently affected by a virus disease, the leaves being curled up and greatly stunted. Dr. Illingworth found this thrips breeding in the diseased buds. There is a possibility that it is the insect transmitter of the trouble.

Mr. D. T. Fullaway exhibited the collection of Ichneumonidae taken by the Pacific Entomological Survey.

Omosita discoidea (Fab.).—Mr. Swezey exhibited a specimen of this nitidulid beetle which he had recently discovered unnamed in the Experiment Station, H.S.P.A. collection. The labels on the specimen indicate that it was found by Mr. Timberlake in a greasy can, at about 6200 feet elevation on the slope of Haleakala, Maui, July 20, 1919. This was in a gulch near Puu Nianiau, and possibly was a camp site where Mr. Timberlake and Mr. C. N. Forbes made one of their camps while on a collecting trip in the summer

of 1919. It is a European beetle, which also occurs in the United States. Its identification was made by comparison with a specimen in a collection of Coleoptera made in California, which were determined by Dr. Blaisdell. This is the only record of this beetle in the Hawaiian Islands.

Tetrastichus sp. near *bruchophagi* Gahan.—Specimens of this parasite were exhibited by Mr. Swezey, who had reared them from fennel seeds in his garden in Manoa Valley, August 15-17, 1933. Only one of its host, *Systole geniculatus* Forst., issued from the fennel seeds, which indicates that the latter was highly parasitized. It was an isolated fennel plant (no other known anywhere in the vicinity), and indicates the ability of these insects to find their hosts.

Bythoscopus robustus (Uhler).—Mr. Swezey reported the recent identification, by Mr. E. P. Van Duzee, of this green bythoscopid which he had collected from Bermuda grass at Kawela Bay, Oahu, April 23, 1933. It is the first record of this insect in Hawaii. The insect occurs all across southern United States from Florida to California.

Oligomerus obtusus Lec. (?)—Mr. Swezey exhibited two specimens of what appears to be this anobiid beetle which had matured August 5 from larvae in oak flooring from the residence of John Waterhouse, Honolulu, brought in by Mr. Ehrhorn, June 7, 1933. The floor was considerably damaged by the larvae of this beetle. It is the first record of its occurrence in Honolulu. This beetle occurs in Canada and the eastern United States.

New immigrant carabid.—A specimen of what appears to be a new immigrant carabid beetle was exhibited by Mr. Swezey, who had caught it on the screen door at his home, the evening of July 9, 1933.

Proterhinus pachycnemis Perkins.—Two male specimens of this beetle were exhibited by Mr. Swezey, who had collected them on a native hibiscus tree in the Waianae Mts. on the ridge above the upper part of Kukuiala Valley, July 16, 1933. This species is remarkable for its very thick fore and hind femora. This is the first record of tree from which collected. Dr. Perkins collected a few in Waianae Mts., but did not record tree from which taken.

Chaetogaedia monticola (Bigot).—Mr. Swezey exhibited a specimen of this tachinid fly which had issued from a noctuid pupa found by Dr. Williams in soil at about 7000 feet elevation on Halaekala, Maui, in the vicinty of Puu Nianiau at the end of the new road, July 26, 1933. The noctuid pupa was different from any known species, so that in this case the host is unknown. It might have been *Euxoa epicremna* (Meyr.) which has been collected previously on the top of Haleakala.

Ophiomyia lantanae (Frog.).—Mr. Swezey reported that he had recently received for identification some of this agromyzid fly that had been reared from lantana berries at Bangalore, India. They were sent him by T. V. Subramaniam, the entomologist there. This is evidence that the lantana seedfly became establlished there from the material taken from Honolulu by Dr. K. Kunhi Kannan in 1921. From that lot he had liberated 250 flies which issued from the lantana berries that he had taken.

Parajapyx isabellac (Grassi).—Mr. R. H. Van Zwaluwenburg reported that Dr. Silvestri had recently identified our common lowland soil japygid as *Parajapyx isabellae* (Grassi). This insect has a very wide distribution, being known from Europe, Japan and China. Silvestri figures it in "Bolletino del Laboratorio di Zoologia Generale e Agraria" of Portici (Vol. 22, p. 79, 1928) and says of it (translated): ". . . distributed throughout the palearctic and nearctic regions south of about the 42nd parallel of latitude." It is the species discussed and figured in Dr. Williams' Handbook (p. 350-351), and has been taken in cane soils on Oahu, Maui, Kauai, and Hawaii. It is particularly abundant in the heavy alkaline soils of Kahuku and Waianae; more than half of all the specimens taken occur between 5 and 9 inches below the surface of the ground.

Chalcolepidius erythroloma Candèze.—Mr. Van Zwaluwenburg reported seeing this species in flight on July 30 on the west side of Kolekole Pass in the Waianae Mountains, about 500 feet below the top of the pass. This elaterid has long been known from the Koolau Range on Oahu, but has apparently not been recorded before from the western part of the island.

Western Pacific Landmass.—Mr. Van Zwaluwenburg stated that Dr. R. Jeannel, in discussing on page 186 (Soc. Ent. de France, Livre du Centenaire, Revision du Genre Limnastis, pp. 167-187, June, 1932), the distribution of the carabid genus Limnastis, makes the following statement: "Et surtout le *Paralimnastis zwaluwenbergi* se trouve à Honolulu. Il y constitute un très intéressant relicte, faisant la preuve quà une époque ancienne, des communications continentales ont dû s'étendre sur tout l'emplacement du Pacifique occidental, depuis l'archipel Malais jusqu'aux iles Hawaii." This conclusion as to extensive land connections in the western Pacific, while in accord with the opinions of malacologists and of some other biologists, is not necessarily the true explanation of the presence here of the minute soil beetle under discussion. Enough shipments of soil have at various times been brought into the Hawaiian Islands (with plants by the ancient Polynesian immigrants and by immigrants from southern China within the past century, and in even larger amounts as ballast in ships) to explain the considerable number of animal species in our lowland soils common to other parts of the world, including Malaysia, the Orient, the Americas and Europe.*

Longevity of Coptotermes formosanus Shiraki.—Mr. Van Zwaluwenburg reported as follows: In March, 1930, a piece of "northwest" pine infested by this species, in termite tests made at McKinley High School, was obtained from Mr. Q. Chock of the Territorial Board of Agriculture and Forestry. Placed in a large glass jar with moist earth, the colony was watered periodically as seemed necessary, and kept under observation until April, 1933. At no time were any castes other than workers or soldiers observed. On May 10, 1932, ten winged forms were added from an outdoor colony. A large larva of *Chalcolepidius erythroloma* was introduced in May, 1931, but failed to develop into an adult beetle; in fact it disappeared entirely. Toward the end of the experiment the most noticeable feature of the nest was the large numbers of *Cyphoderus assimilis* which, with a species of Polyxenus, was the dominant species to survive the termites. Some time between April 8 and April 22, 1933, the termite colony died out,

* This is the larger of the two carabids found in cane field soil, mentioned in Williams' Insects and Other Invertebrates of Hawaiian Sugar Cane Fields, p. 352. The smaller species mentioned there is *Typhlonesiotes atomus* Jeannel (noted in Proc. Haw. Ent. Soc., VIII, 1, p. 24 as *Macranillus atomus* Jeannel).

probably due to exhaustion of the food supply; examination failed to reveal any nymphs or sexed adults present in the débris. Although the possibility of a queen or a neoteinic form having been present at some stage of the colony's existence is not precluded (only a sperficial examination of the colony having been made at the start of the experiment), the absence of young or of sexed forms in the jar, either winged adults or nymphs, suggests the possibility that the individuals originally introduced survived for slightly over three years. Additional and more carefully checked observations would be of interest.

Polycaon stouti Lec.—Mr. Pemberton referred to a specimen of this bostrichid which emerged during August, 1933 from a dresser imported from California by a Maui resident in November, 1929. This is the second individual of this species to be collected from this dresser by Mr. F. W. Broadbent at Puunene. The previous specimen was obtained in August, 1931. (See Proc. Haw. Ent. Soc., Vol. VIII, No. 1, p. 23.)

Mr. J. S. Rosa in speaking of his recent trip to the mainland of U.S.A. commented on the abundance of grasshoppers in North Dakota, in particular, these insects were thickly strewn along the highways and plugged up automobile radiators.

Mr. F. C. Hadden likewise gave an interesting account of his trip to the mainland and made reference to the "flea circus," etc., at the Chicago Fair.

Mr. Ehrhorn spoke of the new termite book from California.

Mr. Van Zwaluwenburg spoke briefly of "Hawaiian Nature Notes" by E. H. Bryan, Jr., as an excellent book and full of information.

Mr. Fullaway mentioned that recently a specimen of *Dendrobates tinctorius,* a frog recently introduced from Panama, had been found at Waiahole, Oahu.

Mr. Pemberton remarked on a recent epidemic of several weeks' duration of the cat flea at Waikiki.

OCTOBER 5, 1933

The 333rd regular meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., October 5, 1933, at 2:30 p.m.

Members present: Messrs. Bryan, Ehrhorn, Fullaway, Hadden, Krauss, Mason, McBride, Pemberton, Riley, Rosa, Swezey, Van Zwaluwenburg, Wilder, and Williams.

President Pemberton called the meeting to order. The minutes of the previous meeting were read and approved as corrected.

Under new business, Mr. N. Krauss, brought up the idea of a Territorial Butterfly, just as the State of California has adopted the Dog Head Butterfly for its Entomological Seal. The Kamehameha butterfly and the Koa bug, as typical Hawaiian insects, had been considered. It was finally agreed to leave the matter for the annual meeting.

NOTES AND EXHIBITIONS

Mr. N. Krauss stated that on a trip to Kamokunui Valley, Waianae Mts., on October 1, 1933, he noted that the guava and Java plum foliage was silvered and the guava fruit cracked, evidently due to the ravages of a dark-colored thrips that had been enormously abundant there.

Insects from fruit of Alectryon.—Mr. Swezey reported the following list of insects having bred from fruits of *Alectryon macrococcus*. About a dozen fallen fruits were collected in Kukuiala Valley, Waianae Mts., September 16, 1933. They were found to be infested by caterpillars and other insects.

From these the following insects were obtained:—

1.	*Acritus basalis* Lec.
4.	" *subbasalis* Scott.
1.	*Nesencyrtus kaalae* Ashm.
70.	*Argyroploce illepida* (Butl.)
2.	*Opogona aurisquamosa* (Butl.)
11.	*Cryptamorpha desjardinsi* (Guer.)
1.	*Drosophila crucigera* Grims.
5.	*Antherigona excisa* (Thomson)
About doz.	Phorids
Numerous	*Neosciara molokaiensis* (Grims.)
4.	*Psychoda inornata* Grims.

11 species

Endynomena pradieri (Fairm.).—Mr. Swezey reported that the carabid beetle exhibited by himself at the previous meeting as a new immigrant, collected on a screen door at his house, July 9, had been determined by Dr. E. C. Van Dyke as this species. It is not new to Hawaii, however, as Dr. Van Dyke pointed out that Blackburn had described it in 1877 as *Saronychium inconspicuum,* which has later been synonomized with *E. pradieri* which was described from Tahiti in 1849 by Fairmaire. An unidentified specimen in the Bishop Museum collected by Perkins at Wailuku, Maui, in 1894, turns out to be this same species. The only previous records are the two specimens collected by Blackburn: one in Honolulu and one on Konahuanui. It is strange that a beetle of this kind is not more often collected.

Pleurotropis wilderi (How.).—Mr. Swezey reported having recently received this determination by Mr. Gahan of the small parasite of *Arachnoleter swezeyi* Cush. and *Tromatobia rufopectus* (Cress.). This is "No. 104, Entedonine sp." of Timberlake (Proc. Haw. Ent. Soc., V, No. 3, p. 441, 1924). This hyperparasite is now known on Oahu, Molokai, and Hawaii. The latest collecting was by Mr. Pemberton, July 28, 1933, at Mountain View, Hawaii, 124 of the parasite having issued from 9 cocoons of Tromatobia which were in an egg-cocoon of *Argiope avara* which was brought in. This egg-cocoon contained 21 Tromatobia cocoons the largest number so far found in one spider egg-cocoon. The Tromatabias had already issued from 12 of their cocoons, the others later yielding Pleurotropis.

Discomyza maculipennis Wied.—Mr. Swezey exhibited a series of 9 specimens of this ephydrid fly that were received September 26, 1933, from Mr. Kilmer O. Moe of Kahili, who had bred them from dead sea shells. The shells had been exposed for ants to clean out the dead remains. Later, when confined in an exhibition case, the flies issued. It is a species somewhat resembling the ortalid *Notogramma stigma* (Fab.) which breeds in decaying fruit, rotten sugar cane, etc., here. The only previous record of this ephydrid is in Proc. Haw. Ent. Soc., VI, p. 236, 1926. It was similarly bred from improperly cleaned sea shells.

Nesodryas (Nesothöe) maculata Muir.—A specimen of this delphacid was exhibited by Mr. Swezey who had collected it on

Maba hillebrandii in Kukuiala Valley, September 16, 1933. This insect was collected originally on Hawaii in 1915. Apparently this is the first record of its occurrence on Oahu.

Erebus odora (Linn.).—Mr. Swezey reported that a female of this moth, kept confined in a pasteboard box, laid a large number of eggs before death. No count was made of the eggs, but the caterpillars which hatched, and died in the box, were counted with a total of 386.

Sybra alternans Wied.—Mr. Swezey recorded the occurrence of this cerambycid on Molokai, he having collected a specimen at Kawela on that island, September 30, 1930. Apparently it had not been previously recorded on Molokai, nor has it been taken on any of the other islands except Oahu, where it has been known since 1918, and is now very common, its larvae feeding in dead stems of most kinds of trees and shrubs of the lowlands.

Trichogramma minutum Riley.—Mr. Swezey exhibited a vial with 43 of this egg-parasite which had issued from two eggs of the Kamehameha butterfly, *Vanessa tammeamea* Esch. Four eggs had been found, three of them on the under side of a leaf of *Urera sandwicensis* in Kamokunui Valley, Waianae Mts., October 1, 1933; the other egg on a leaf of *Pipturus albidus* which is the most usual host of the Kamehameha butterfly. From two of these eggs, parasites had already issued. The parasites issued from the two others on October 3.

Ceratitis capitata Wied.—Dr. Gerrit Wilder said that only 1% of his five varieties of mangoes had been stung by the fruit fly.

Argyroploce illepida (Butl.)—Mr. E. M. Ehrhorn spoke of the caterpillar of *Argyroploce illepida* on macadamia nuts—about 6% found this month. It only damages the outside shell, so far. None found in the nut meat. More abundant this year than last year.

Coleotichus blackburniae White.—Dr. F. X. Williams stated that on September 24, 1933, he found the moult skins of *Coleotichus blackburniae* (Scutellarinae), our largest native bug, very abundantly on Tantalus, along the Sugarloaf trail that runs

through the planted *Acacia koa* forest to Hering Valley. These cast skins, which appeared to be those mainly of the last nymphal stage, could be gathered in hundreds along the 1000-foot stretch of the trail through the koa forest. A few young and adult bugs were to be found on the under cover of Commelina plants. This bug is attached chiefly to koa.

He also commented upon the abundance of *Elimaea punctifera* (Walker) the large green long-horned grasshopper, along a stretch of above-mentioned koa forest trail. These insects were resting upon tall Commelina. Twenty-one adults were easily caught with the hand in a short time. Immature specimens appeared less common. Twenty of the mature ones were fed in succession to two large *Bufo marinus*.

Anax strenuus Hagen.—Egg slits in submerged Commelina stems, and the young of this dragonfly that had issued therefrom, were exhibited by Dr. Williams.

Diorymerellus laevinargo Champ.—Mr. D. T. Fullaway spoke of this orchid weevil as being present in orchids imported from eastern United States.

Immigrant carabid.—Mr. C. E. Pemberton mentioned a black carabid beetle given him by Dr. H. L. Lyon, and resembling *Pterostichus californicus* which had been found in the tight greenhouse at the Vineyard street nursery. It was probably a stowaway from California.

NOVEMBER 2, 1933

The 334th monthly meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., November 2, 1933, at 2:30 p.m.

Members present: Messrs. Bryan, Ehrhorn, Hadden, Illingworth, Keck, Krauss, Marlowe, Pemberton, Rosa, Smith, Solander, Swezey, Van Zwaluwenburg, and Williams.

Visitor: H. D. Kirschman.

President Pemberton called the meeting to order. The minutes of the previous meeting were read and approved as corrected.

NOTES AND EXHIBITIONS

Lema nigrovittata Guerin.—Mr. N. Krauss exhibited several specimens of a chrysomelid beetle of the genus *Lema* which a local University student had secured. More data are to be obtained on this insect.

Identification of Toad From Kauai.—Mr. C. E. Pemberton stated that specimens of a toad known to occur in some of the elevated, swampy portions of the island of Kauai, have been obtained from Mr. Albert Duvel of the Experiment Station, H.S.P.A. One of these was sent to Dr. Joseph R. Slevin, Curator of Herpetology, California Academy of Sciences, who found it to be the Oriental toad *Bufo bufo asiaticus* Steindachner. He states that it is a common Oriental species and probably only a color variation of one known in Japan as *Bufo vulgaris japonicus* Schlegel. *Bufo bufo asiaticus,* according to Okada, occurs in eastern Mongolia, Manchuria, Amurland, northeastern China from Peking and Chefu to Shanghai and has been spread throughout Korea. We can find no definite record of when this toad was introduced to Hawaii or by whom.

Nephus pictus Gorh.—Mr. Swezey reported having collected one of this ladybeetle by sweeping on an *Erythrina monosperma* tree in Kamokunui Valley, Waianae Mts., October 1, 1933, at a place a mile or more above the upper cane fields of Waialua Agricultural Company.

Pachycrepoideus dubius Ashm.—Mr. Swezey reported having bred this parasite abundantly from puparia of *Drosophila melanogaster* Sturt. The drosophilid larvae had fed on pulp of fallen mangoes, October 10-20, 1933. It was the first time he had reared this parasite in any quantity.

New Cecidomyid.—Mr. Swezey exhibited specimens of a cecidomyid, as yet undetermined, and apparently not previously recorded in Hawaii. The flies had issued abundantly in a jar containing mango seeds on which there had been more or less pulp, fermenting and finally drying. The seeds were being held for observing the time of issuance of the mango weevil. Apparently the larvae of the cecidomyids had fed in the pulp.

Athesapeuta cyperi Marshall.—Mr. Van Zwaluwenburg reported finding the grub of this introduced weevil in nutgrass on October 13 in a field of the former Makee Sugar Company, just north of the Wailua River. This is the first record of this insect on Kauai.

Vespa occidentalis Cresson.—This ground-nesting yellow jacket was found fairly common last month in the mauka cane fields at Lihue and Makaweli on Kauai, by Mr. Van Zwaluwenburg. At the latter place, laborers were already complaining of its vicious stinging. Apparently first taken in the highlands of Kauai by J. A. Kusche in 1919, the first published record of its occurrence in the Islands was the capture of a specimen in the Alakai Swamp, Kauai, by Messrs. Agee and Rock in 1920. Dr. Williams in 1930 saw several of these wasps in cane fields at Kilauea Plantation. If the species becomes generally established in the cultivated areas of the lowlands, as now seems probable on Kauai, it is apt to become a serious nuisance to cane field workers.

Discomyza maculipennis Wiedemann.—Mr. Bryan reported that the species of fly reported by Mr. Swezey at the last meeting as being bred by K. O. Moe from dead shells, belongs to this species of the family Ephydridae. The record of its having been bred from improperly cleaned sea shells in April, 1925, at Bishop Museum, is given in the Proceedings, Vol. 6, page 236. In addition, a large series of specimens collected on Lisiansky Island, to the northwest of Kauai, by S. C. Ball, in May, 1923, on the Tanager Expedition, also belongs to this species. M. Bezzi (Diptera Brachycera and Athericera of the Fiji Islands, 1928, p. 154) states that this species is widely spread throughout the whole Oriental Region, and is common in the Philippines as well as in the Mascarene Islands. It was taken in Fiji.

Hister bimaculatus L.—Dr. Williams mentioned that he had taken a specimen of this beetle from filter press mud in a field of the Hilo Sugar Company, Hawaii, in July, 1932, and a second specimen about stable manure at Ookala, Hawaii, in the latter part of October, 1933.

DECEMBER 7, 1933

The 335th regular meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., December 7, 1933, at 2:30 p.m.

Members present: Messrs. Bryan, Carter, Ehrhorn, Fullaway, Hadden, Illingworth, Ito, Krauss, Mason, McBride, Pemberton, Rosa, Solander, Miss Suehiro, Messrs. Swezey, Van Zwaluwenburg, Weinrich, and Williams.

Visitor: H. D. Kirschman.

President Pemberton called the meeting to order.

The minutes of the previous meeting were read and approved.

The Secretary read the financial statement of the Society for the year commencing December 1, 1932, and terminating December 6, 1933. The statement was approved subject to audit. The president appointed Mr. Ehrhorn as auditor.

Election of officers for the ensuing year, 1934, as follows:

President—Mr. O. C. McBride

Vice-President—Dr. Walter Carter

Secretary-Treasurer—Mr. R. H. Van Zwaluwenburg

Additional members of the Executive Committee—Messrs. O. H. Swezey and C. E. Pemberton.

Mr. Krauss then presented a resolution to the Society as follows:

Whereas, many states of the American Union have adopted State Birds, State Flowers and State Trees, to promote pride in state and an interest in nature, and

Whereas, the entomologists of at least one state have adopted a State Butterfly or State Insect, and

Whereas, many butterflies and other insects are fully as attractive and interesting as flowers and birds, and

Whereas, the beautiful butterfly known as the Kamehameha (*Vanessa tammeamea* Esch.) is the only conspicuous native butterfly in Hawaii and is widely distributed in these islands and is named for a great Hawaiian king, *therefore*

Be it resolved, that the Hawaiian Entomological Society hereby adopt the said Kamehameha Butterfly as the Territorial Butterfly or Insect, and

Be it further resolved, that an appropriate seal be made which shall depict this species, and that this shall be known as the Entomological Seal of the Territory of Hawaii, and

Be it further resolved, that action be taken to have the Kamehameha Butterfly officially adopted by the Legislature of the Territory of Hawaii as the Territorial Butterfly.

It was moved and seconded that the motion be adopted. Carried.

President Pemberton then gave his Annual Address, entitled: **"Some Future Work for the Entomologist in Hawaii."** The address was very much to the point and it is hoped that some of its suggestions will be followed up.

Dr. Carter spoke on behalf of Dr. R. N. Chapman for new membership into the American Association of Economic Entomology and gave in a communication to that effect.

Also on behalf of Dr. Chapman, Dr. Carter read a communication respecting the extension of the loan of the entomological exhibit at the Century of Progress Exposition at Chicago. The matter was referred to the Chicago Fair Committee.

Dr. Carter (referring to the presidential address) suggested that it would be of value to the entomologists of the Islands if the Entomological Society here approve or take other action in regard to advising small farmers and garden citizens in combatting insect pests and that it look into the question of insecticides, particularly with reference to labelling of the products, and their effectiveness.

PAPERS

Mr. Swezey presented a paper entitled: **"Harroweria gloriosa Hebard, a Katydid stowaway from Panama (Orthoptera; Tettigoniidae).**

"New Hawaiian Lepidoptera," by O. H. Swezey.

Mr. Bryan presented a paper by title: **"A Review of the Hawaiian Diptera, with descriptions of new species."**

Dr. Illingworth presented: **"Notes on the habits and life history of Sciara molokaiensis Grimshaw, a serious pest of the roots of plants in Hawaii (Mycetophilidae)."**

"Life history and habits of Apelma brevis Johannsen (Chironomidae)."

Dr. Carter presented a paper entitled: **"Notes on two pests of Pineapple not known in Hawaii."**

NOTES AND EXHIBITIONS

Orthoea nigriceps (Dallas).—Mr. N. Krauss reported this myodochid bug flying in thousands about street lights in the grounds of the Mid-Pacific Institute and the University of Hawaii, Manoa, November 8, 1933.

Tenodera angustipennis Sauss.—Mr. N. Krauss reported a specimen (adult) from near the Libby Pineapple Cannery at Kuiaha, near Haiku, Maui, collected January 5, 1932.

Molokai insect notes.—Dr. Williams exhibited a few specimens recently taken by him in the mountains behind the Puuhoku Ranch, East Molokai. The exhibit included the large green dolichopodid fly *Liancalus metallicus* Grims. occurring chiefly on boulders in the Moalua Stream; an Agrion (damselfly) reared from a nymph from the base of an Astelia lily plant; and an adult specimen of the pepper weevil (*Anthonomus eugenii* Cano) on Chili pepper in the Papio Gulch, 700 feet elevation. This appears to be the first record for this weevil in the Hawaiian Islands outside the island of Oahu.

Neotrichus latiusculus (Fairm.).—This colydiid beetle was exhibited by Mr. Swezey, who had recently come across two specimens among some unidentified material. One specimen was collected by him at Hilo, Hawaii, July 25, 1921, and the other in Puna, Hawaii, May 10, 1926. This species has not hitherto been recorded in the Hawaiian Islands. Identification was made by comparison with specimens from Samoa at the Bishop Museum. The species was described from Fiji in 1881.

Acythopeus sp.—Mr. Swezey exhibited specimens of an orchid weevil different from the usual *Acythopeus aterrimus* (Waterhouse) which has been known in orchid houses in Honolulu for quite a number of years, being first found in 1910. The present specimens are smaller in size than *aterrimus*, uniformly black in color, and resemble the latter to such extent that they were mistaken for it. Recent careful comparisons, however, bring out

several minute structural differences. These specimens were from Mr. Frank C. Atherton's orchid house, March 1, 1928.

Lasioderma serricorne (Fab.).—Mr. Swezey exhibited a small jar of a table salt mixture in which were numerous larvae, pupae and adults of the cigarette beetle. It is not known what is the ingredient on which the larvae feed.

Drosophila immigrans Sturt.—Mr. Swezey exhibited a bottle of drosophilid flies which were obtained from one flower of *Aristolochia gigas* that Mr. E. L. Caum had brought in from the Arboretum in Manoa Valley, November 24, 1933. This flower is so constructed as to retain the flies which enter its throat. It is provided with a foul odor to attract the flies; 2808 flies were counted, and Mr. Caum estimated that about ¼ had escaped. They were nearly all of the one species, *immigrans;* but there was one specimen of a spotted winged native species of Drosophila apparently undescribed.

Pycnoderes 4-maculatus Guerin.—Reported by Dr. Illingworth as a serious pest of pole beans in the Waialae district. He first discovered this bug in the Islands feeding on purslane, December 11, 1929 (Proc. Haw. Ent. Soc. VII, 466, April, 1931). It is a pest from California, where it is injurious to cucurbitaceous plants. Essig also reports it as a pest of beans.

Heterodoxus longitarsus Piaget.—Mr. Pemberton reported that on March 15, 1933, C. W. Carpenter collected a number of lice from a dog at Waikiki, Honolulu. Specimens of these were mounted and tentatively identified as the Kangaroo louse, *Heterodoxus longitarsus* Piaget, by Dr. J. F. Illingworth. Specimens were sent to Dr. G. F. Ferris, Stanford University, who in a letter dated October 27, 1933, has verified the identification. This is the first record of this species occurring in Hawaii.

Scelio pembertoni Tim.—Mr. Pemberton reported that three adults of this imported parasite of the grasshopper *Oxya chinensis* (Thun.) were taken at Wailuku Sugar Company, Maui, at two points where the parasite was liberated two years previously. This is the first record of the establishment of this parasite on the island of Maui.

Notes on Two Pests of Pineapple Not Known in Hawaii.[1]

BY WALTER CARTER

(Presented at the meeting of Dec. 7, 1933)

The observations recorded in this paper were made in the fall of 1932 in Jamaica and Guatemala and concern two borers of pineapple, one, the pineapple stem borer (*Metamasius ritchiei* Marshall) and the other, a Lepidopterous borer which has apparently not yet received a common name (*Thecla echion* [Linn.]).*

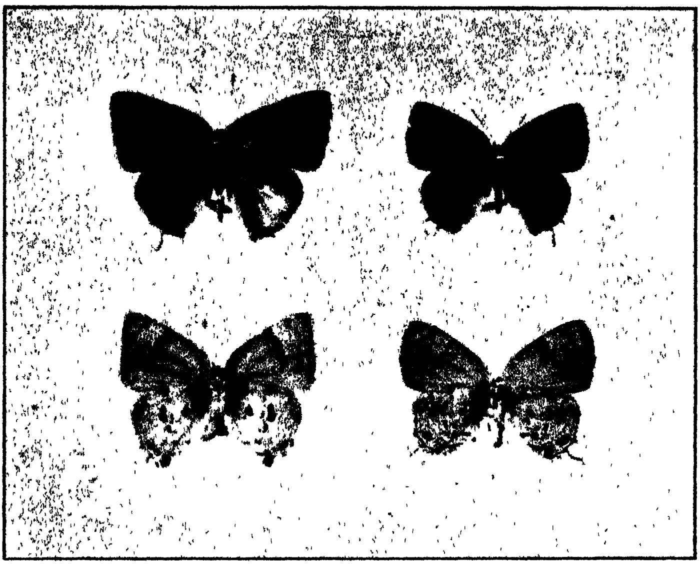


FIG. A. *Thecla echion* (Linn.)
Adults: ♂ and ♀ (Courtesy U. S. N. Museum)

M. ritchiei was studied in Jamaica at the time of its first finding and but little has been added since that time. It has remained closely localized in the type locality which is a densely wooded

[1] Published with the approval of the Director as Technical Paper No. 69 of the Experiment Station of the Pineapple Producers Coöperative Association, University of Hawaii.

* Identified by Mr. Carl Heinrichs, U. S. National Museum. (There is some uncertainty with regard to the use of the name *Thecla echion*, for the butterfly which was introduced from Mexico into Hawaii, whose larva feeds on the flower heads of lantana, has also been identified as *echion*.—ED.)

area. There, pineapples are grown in small scattered plantings with little cultivation and under extremely humid conditions. Under these conditions, the borer is an extremely serious pest. It bores through the stem of fruiting plants, emerging through the fruit, which is completely ruined in the process. It attacks young growing suckers, the borings reaching to the growing point. Plants were seen with evidence of a double attack, young larvae being found in a stump already traversed by old borings.

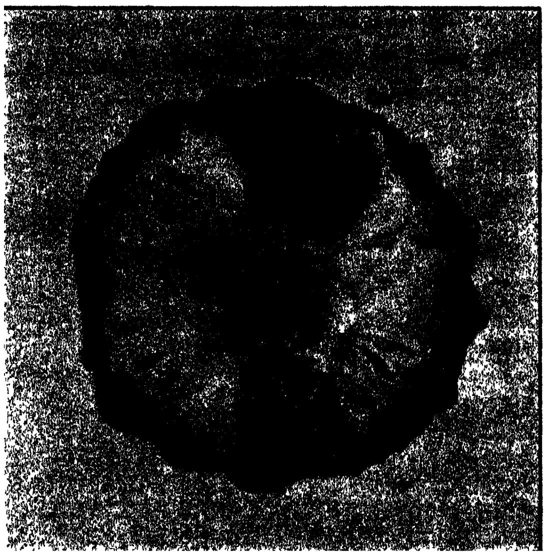


FIG. B. Section through small immature pineapple showing work of larvae in fruit tissue.

In spite of its seriousness in the one locality there appears to have been no spread into other localities in spite of the fact that some movement of planting material has taken place into other locations in Jamaica where pineapples are grown. These facts suggest the possibility that the insect has specialized environmental requirements which limit its spread to other areas. No pineapples are grown in Hawaii in any environment even approximating that in which it succeeds in Jamaica. On the other hand, the barrier interposed by dense and varied tropical vegetation which separates pineapple plantings may be too great for the insect to surmount.

The lycaenid butterfly, *T. echion,* for which the name "pineapple fruit borer" is proposed, was found in Guatemala at Montufar, Palin, and Escuintla. The larva is approximately one inch long when mature, of a salmon pink color and appearing somewhat flaccid on account of an uneven integument and a slightly flattened shape. It is found principally at the base of the young growing slips, boring in at the attachment of slip and fruit. Sometimes it is found boring into the fruit above the point of attachment of the slips. Its curious flattened shape and flaccid body are admirably adapted to its boring habit. It can, when disturbed, bore with extreme rapidity.

No certain evidence of parasitism was observed but the insect is not common in the areas where it was found for out of several hundred fruits examined less than a dozen larvae were obtained.

Both species of insect mentioned above are dangerous potential pests to pineapple in Hawaii for, although they are limited either in numbers or in distribution in their native habitats, the situation in Hawaii provides a condititon not encountered where they are found, namely, continuous cultivation of pineapples in large pure stands.

A Review of the Hawaiian Diptera, with Descriptions of New Species

BY E. H. BRYAN, JR.

(Presented at the Meeting of December 7, 1933)

The order Diptera has probably been the most neglected major order of insects in Hawaii. The only general account of Hawaiian two-winged flies is that which appears in the Fauna Hawaiiensis, except for brief discussion of some of the groups by Williams (1931). A few excellent papers and numerous notes, dealing with individual families, genera, or species, have appeared, but no recent general summary of the whole order has been published. The Fauna Hawaiiensis recorded 135 endemic and 57 immigrant species; the former in 27 genera, the latter in 46. At present there are known to occur in these islands about 325 described species, belonging to 130 genera, and representing 42 families. (Compare Perkins, 1913, p. clxxx).

In 1919, at the suggestion of Professor D. L. Crawford, the writer began to compile a card catalog of the species of Diptera recorded from Hawaii and references to them. In 1924 a manuscript on the "Diptera of Hawaii" was submitted to the University of Hawaii as a thesis toward the degree of Master of Science. The present paper attempts to summarize the information which has been accumulated; to present a list of the species now known to occur in Hawaii, together with a bibliography and discussion of the principal references to them; and to describe new species, descriptions of which appear in the author's thesis and other unpublished manuscripts.

EARLY REFERENCES TO HAWAIIAN DIPTERA

The early references to Hawaiian entomology were discussed by J. F. Illingworth (1923). He cited several early accounts which indicate that domestic flies were troublesome at a very early date. David Malo (1903, p. 65), a native Hawaiian, writing about 1832, mentioned as native the common house fly or *nalo,* but included the mosquito (*makika*) among "the creatures recently imported

from foreign lands," as did Jarves (1843, p. 10). Charles Pickering, in the report of the U. S. Exploring Expedition (1848, p. 333) discussed the connection between house flies and man, stating that such flies are absent on uninhabited islands, but present where man has been. He also discussed the introduction of mosquitoes, as did Cheever (1850, p. 105).

The earliest systematic descriptions of Hawaiian Diptera were written by Thomson (1868), in working up the specimens collected on the voyage of the Swedish frigate "Eugenie," which visited Hawaii in August, 1852.

Rev. Thomas Blackburn, who came to Hawaii in 1877, made extensive collections which added much to the knowledge of most orders of insects in these islands. But apparently he did not care for flies, for he said little about them, except that there were "too many Diptera of the mosquito type," (1877, p. 227).

THE FAUNA HAWAIIENSIS

It was not until the arrival of R. C. L. Perkins in 1892 that Diptera were carefully collected. A rather large percent of the native flies known today were described, from Perkins' material, in the Fauna Hawaiiensis. Also, quite a number of the immigrant species were recorded in that monumental work. Grimshaw (1901 and 1902) recorded 185 species, 111 of which were described as new. Speiser (1902) described two new species and one new variety of Hippoboscid flies. And Perkins (1910) described six species and recorded five more which he had already described. In the "Introduction," Perkins (1913) gave a careful résumé of all the families of Diptera known in Hawaii at that time.

Just prior to the appearance of Grimshaw's first paper, L. O. Howard (1901) presented to the Entomological Society of Washington a list of the Diptera collected in Hawaii by H. W. Henshaw. This contained mention of 19 species, 5 of which were not specifically determined. The records were repeated by Grimshaw.

MORE RECENT CONTRIBUTIONS

More recent work on Hawaiian Diptera has been largely of an economic nature, although some taxonomic papers have been published. In 1906, F. W. Terry produced a preliminary account of

the Diptera of economic importance, in which he noted several injurious and beneficial species. Although Terry carried on extensive research and breeding, most of his work was lost at the time of his sudden death in November, 1911. In 1910 he presented as a presidential address before the Hawaiian Entomological Society a paper entitled "Biological Notes on Hawaiian Diptera," but only a few items and the description of a new genus and two new species of Chironomidae were published (1913).

The most serious dipterous pests are the two fruit flies: *Chaetodacus cucurbitae*, the melon fly, and *Ceratitis capitata*, the Mediterranean fruit fly. A large number of papers and notes have appeared concerning these. There are several references to Diptera attacking or annoying cattle, horses, and other live stock, especially one paper by Van Dine and Norgaard (1908) and one by Bridwell (1918). Several papers and notes have appeared on mosquitoes, and there are numerous references to beneficial Diptera, such as certain Syrphidae, Pipunculidae, Tachinidae, and Drosophilidae. The principal recent papers and most of the notes have appeared in the Proceedings of the Hawaiian Entomological Society, with a few in publications of the local experiment stations. Papers on individual families, genera, and species will be referred to in the discussion of these groups, given below.

ACKNOWLEDGMENTS

J. F. Illingworth has done much to obtain identifications of Diptera, especially muscoid flies. F. X. Williams gave an excellent, well-illustrated summary of numerous species found in sugar cane fields (1931), and has helped to advance the knowledge of flies associated with water. Otto H. Swezey and other entomologists have assisted greatly by collecting and breeding specimens, which have been made available to the writer by the experiment stations and institutions with which these entomologists were associated.

The writer is greatly indebted to J. M. Aldrich, Charles P. Alexander, E. T. Cresson, Jr., C. Howard Curran, O. A. Johannsen, J. R. Malloch, the late M. Bezzi, and others, for helpful assistance in obtaining correct identifications of numerous species.

The following species are described as new in this paper:

Calliphoridae: *Dyscritomyia terryi* n. sp.
Drosophilidae: *Idiomyia grimshawi* n. sp.
Drosophila z-notata n. sp.
Drosophila fuscoamoeba n. sp.
Drosophila punalua n. sp.
Drosophila nigra Grimshaw variety *iki* n. var.
Drosophila kauluai n. sp.

RÉSUMÉ OF THE FAMILIES OF DIPTERA FOUND IN HAWAII

Family LIMONIIDAE (Limnobiidae)

Fifteen species of craneflies have been identified from Hawaii. These are now placed in four genera, and all belong to the subfamily Limoniinae.

Grimshaw (1901, pp. 6-7) described *Libnotes perkinsi*, six species of *Dicranomyia, Trimicra lateralis*, and *Styringomyia didyma*. Alexander found two of these species of *Dicranomyia* preoccupied (1911 and 1919). He renamed them and described two new species in 1919, one in 1923, and one in 1924 (see bibliography under these dates). Swezey (1915) described *D. foliocuniculator*, with leaf-mining larvae.

Perkins (1913, p. clxxxii) suspected that *S. didyma* was an immigrant species; and this was substantiated when Edwards (1911) synomymized *Idiophlebia pallida* of Grünberg (1903) with it, and noted a wide distribution in his revision of the genus (1914). Alexander (1919, p. 30) noted it as "apparently well distributed throughout parts of Australasia;" (see also Alexander, 1923, p. 251).

Edwards (1921) synonymized *Trimicra lateralis* with *Trimicra pilipes* (Fabricius); (see also Alexander, V: 251, 1923).

Alexander (1919) described *Gonomyia (Lipophleps) hawaiiensis*. In a check list (1932), he considered both *Libnotes* and *Dicranomyia* as subgenera of *Limonia*.

One of the most interesting features of Hawaiian craneflies is the leaf-mining habit of *L. foliocuniculator* and possibly other related species. The native species are found along streams in the

mountains, some locally abundant, "dancing" against rocks and tree trunks. The immigrant species are mainly found in the lowlands. Craneflies are preyed upon by Mimesid wasps. (Perkins, 1913, p. clxxxii and Williams, VI: 435, 1927).

Family PSYCHODIDAE

Grimshaw (1901, p. 6) described *Psychoda inornata* and recorded *P. alternata* Say. Mrs. O. H. Swezey (I: 116-118, 1907) published life-history notes on *P. inornata* "or an undescribed species." *P. alternata* was found breeding in a house drain on Molokai (Illingworth, VI: 394, 1927).

Bridwell (IV: 248, 1920) reported a "black species" at Waikiki, which may be the same as a dark-winged species taken very abundantly about the lighthouse on Sand Island, Honolulu harbor, 1923, and as yet undetermined. Various other undetermined species have been noted.

Telmatoscopus albipunctatus was reported by Williams (VIII: 18, 1932), and has since become fairly abundant on Oahu, being found about sinks and on windows, and breeding in small puddles with mosquito larvae. This is the species recorded by Illingworth (VII: 378, 1931) as having been collected in Makiki, Honolulu, by G. P. Wilder. Specimens were also determined by Aldrich for Bryan (VIII: 230, 1933).

Family CULICIDAE

There are but three species of mosquitoes known in Hawaii, two day-flying, and one night-flying, although it may be possible that other species may occur here (see Ehrhorn, V: 194, 1923). All are immigrants, having arrived since about 1825, for none was known prior to that date according to various accounts (Montgomery, 1831; David Malo, 1903; Bryan, VIII: 3, 1932). Several theories are given as to their mode of arrival (Osten Sacken, 1861 and 1884; Van Dine, 1904; Kirkaldy, I: 121, 1907). The night-mosquito, *Culex quinquefasciatus,* (also called *Culex fatigans*) apparently arrived in water casks on a ship from Mexico about 1826; the two day-mosquitoes, *Aedes albopictus* and *A. aegypti*, at a later date. Perkins (1913, p. clxxxi) noted *A. albopictus ("Stegomyia scutellaris")* as not having been at all abundant when he began collecting in 1892-3. Both day-mosquitoes are so

widespread in the Pacific that their origin cannot be determined; they doubtless arrived in commerce. *"Stegomyia scutellaris"* var. *samarensis* was described from Oahu by Ludlow (1903).

There are numerous references to mosquitoes in Hawaii, the principal ones being: Smith (1904), Van Dine (1904), Terry (1906, pp. 36-37), Knab (1906), Fullaway (1913), Warren (1915), Bridwell (1918), Bryan (V: 291, 1923), Swezey (VII: 12, 1928), Williams (1931, p. 275), and the Anti-Mosquito League (1931). Illingworth (VII: 414, 1931) suggests control with arsenic spray.

All three species are widespread in Hawaii, principally in the lowlands; *A. aegypti,* the yellow-fever mosquito (which apparently transmits neither yellow fever nor dengue fever in these islands) being distinctly domestic, and *A. albopictus,* more a "forest day-mosquito" in the lower forest and valleys. *A. albopictus* has been known here as *Aedes* and *Stegomyia scutellaris* (see Edwards, 1916-1917, p. 209, fig. 5; and 1926, p. 101).

Megarhinus inornatus Walker, a large mosquito from New Britain, the adults of which are harmless, and the larvae of which prey upon the larvae of other mosquitoes, was introduced by Pemberton in 1929 (VII: 360, 1931), but it apparently has not become established (Williams, 1931, p. 279).

Family CHIRONOMIDAE

An endemic genus, *Charadromyia,* and two species, which fly and breed about wet rocks in mountain streams, were described and figured by Terry (II: 291-5, 1913); see also Perkins (1913, p. clxxxi). Illingworth (VII, 408, 1931) recorded one of these, *C. torrenticola,* from Oahu. Williams (1931, p. 275) gave a note concerning these flies.

Grimshaw (1901, p. 4) described and figured *Chironomus hawaiiensis,* which Warren (1915) listed as a favorite food of dragonflies, and Williams (1931, p. 275) as eaten by lizards. This species is sometimes common in the lowlands, the larvae ("blood-worms") breeding in standing water (see Terry, 1906, p. 37; and Perkins, 1913, p. clxxx).

Grimshaw (1901, p. 5) noted an unnamed species of *Orthocladius.* Another undescribed species has been referred by Johannsen to the subgenus *Psectrocladius.*

Grimshaw (1901, p. 5) described *Tanytarsus lacteiclavus* from Kauai. Swezey and Williams (VIII: 187, 1932) also recorded it from Hawaii. Dragonflies and other enemies of this midge were noted by Williams (July 6, 1933).

Aldrich determined specimens collected by Illingworth on water, in 1928, as *Metriocnemus* sp.

Family CERATOPOGONIDAE

Grimshaw (1905, p. 5) noted and figured *Ceratopogon* sp. from Oahu; and Bridwell (IV: 284, 1920) recorded another species of this genus. Related specimens, sent to Johannsen, were referred to the subgenus *Prohelea*. Perkins (1913, p. clxxxi) stated that more species probably exist in the mountains. At times small clouds of these gnats are to be seen.

Apelma brevis, described by Johannsen (1927), was reported as abundant in pineapple fields, where the larvae and pupae are active in water in the axils of the leaves (Illingworth, VII: 206, 255, 1929). Illingworth (December 7, 1933) presented a paper on its life history.

Family MYCETOPHILIDAE

Three large, dark, endemic species of *Platyura* were described by Grimshaw (1901, pp. 2-4, pl. I:2-5). Perkins (1913, p. clxxx) noted: "It is probable that the truly endemic forms are numerous, the larvae being very plentiful in decaying vegetation, where they are preyed upon by the small carabid beetles, and, if they have been exposed, are also seized upon by minute carnivorous flies belonging to the Dolichopodidae. A number of species [Sciaridae ?] have been imported with foreign plants and have become very abundant, so that it may not be easy to discriminate the foreign from the native species in these obscure flies."

Family SCIARIDAE

Many small fungus gnats have been referred to *Neosciara molokaiensis*, described (as *Sciara*) by Grimshaw (1901, p. 2, pl. I: 1). This group needs extensive collecting and critical study. From a large series Professor O. A. Johannsen distinguished specimens of two other species of Neosciara which still remain

undescribed. These gnats are widely distributed in Hawaii and are seasonally very abundant. The larvae are said by Illingworth (1926, p. 30 and VII: 254, 1929) to gnaw tender young pineapple roots. Williams (1931, p. 275) gave notes on them. This or a closely related species was collected on Midway and Cure Islands (Bryan, 1926, p. 67). Illingworth (December 7, 1933) presented a paper on their life history.

Family SCATOPSIDAE

Bridwell (IV: 284, 1920) reported an "additional species of Bibionid fly" belonging probably to *Scatopsis,* captured in a salt marsh at Waikiki, May 30, 1919. The other species, which Bridwell says is "referred to a different genus" is not known to the writer.

Rhegmoclema atrata was captured in a parasite cage from California in 1915. It is not known to be established.

Family CECIDOMYIIDAE (or Itonidae)

Gall midges are so frail and delicate that they have been largely overlooked and their determination neglected. Swezey (I: 79, 1907) reported that *Contarinia* or *Diplosis sorghicola* was bred from sorghum tops, *Contarinia solani* from tomato buds, and an undetermined species from larvae feeding on the spores of rust on sorghum leaves. *Contarinia maculipennis* was described by Felt (VIII: 247, 1933) from specimens reared from hibiscus buds by Swezey (VII: 370, 1931 and VIII: 212, 1933). Illingworth had noted it about 1928; and Fullaway reported (January 5, 1933) breeding it from buds of "pikaki," *Jasminum sambac.*

Phaenabremia meridionalis was reported by Williams (VII: 372, 1931), identified by Barnes, in 1929, as the "Itonidid," the orange larvae of which feed on sugar cane aphis, as noted by Osborn (IV: 329, 339, 1920); see also Williams (1931, p. 274). Timberlake also recorded a native "Itonidid" in *Pelea clusiaefolia,* on Oahu (III: 380, 1918).

Lobodiplosis pseudococci was described by Felt (1933) for a midge enemy of *Pseudococcus brevipes,* which had been introduced to Oahu from Mexico by Fullaway in 1930. It was recovered on

Oahu, August 23, 1932, by Chock (VIII: 237, 1933). Schmidt reported (January 5, 1933) that it was well established in some pineapple fields.

Bridwell (IV: 42, 1919) bred a Cecidomyid from the remains of *Livistona* palm seeds which had been partly destroyed by a Scolytid beetle.

Swezey (November 2, 1933) reported breeding an undetermined species from mango seed refuse.

Family STRATIOMYIIDAE

Four species of "soldier flies," all immigrants, have been recorded.

Neoexaircta spinigera, an Australasian species, is recorded by Grimshaw (1902, p. 79). Perkins (1913, p. clxxxii) says that it was not noticed in 1897, but was common about Honolulu in 1900. It is at present widespread, even up into the lower forest zone, probably on all the main islands. Notes concerning it were given by Pemberton (III: 285, 1917), and Williams (1931, p. 280) gave a good figure. Illingworth (VII: 252, 1929) noted it as doing minor injury to a papaya trunk. The larvae breed beneath decaying bark in the forests, and the flies are preyed upon by Crabronid wasps.

Evaza javanensis was first reported (undetermined) by Grimshaw (1902, p. 79). It was known to Terry as "*Acanthina* sp."; and finally determined by Brunetti (Bryan, V: 349, 1924). It is a native of the Malay region, and not uncommon in parts of Hawaii, having probably arrived about 1900.

Hermetia illucens, a widespread tropical and subtropical American species, was first reported by Williams (VIII: 232, 1933), having been noticed near Hilo, Hawaii in 1930, and bred from filter-press mud in 1932. It is also in Samoa (Ricardo, 1929, p. 109).

Microchrysa hovas, recorded as "Sargus sp." by Howard (1901), Grimshaw (1901), and Terry (1906, p. 37) who gave life-history notes, was determined by Brunetti (Bryan, VI: 369, 1927) as *Cephalochrysa hovas.* Ricardo (1929, p. 116) in recording it from Samoa, changed the genus to Microchrysa. It is wide-

spread, but rather rare, in Hawaii. Perkins (1913, p. clxxxii) stated that it was known in Honolulu in the early '80s. It is a south Asiatic species.

A quite distinct, undetermined species is known from Laysan (Bryan, 1926, p. 67).

Family SCENOPINIDAE

Grimshaw (1901, p. 11) recorded *Scenopinus niger*. The occurrence of *S. fenestralis* in Hawaii was noted by Brunetti (1920, p. 312). Bryan (V: 365 and 368) gave notes on these two species, and (VIII: 245, 1933) recorded *S. fenestralis* on Kaula Islet. The records of *S. fenestralis* are probably misidentifications of *S. lucidus,* found on windows, which was identified by Aldrich (Illingworth, VII: 233, 1929), from specimens collected on ripe pineapples on Lanai. (See also Bryan VII: 335, 1931, and Williams 1931, pp. 280-281).

Family DOLICHOPODIDAE

A very complete summary of the Hawaiian Dolichopodidae is given by Van Duzee (VIII: 307-348, 1933), in which he describes two new genera and 32 new species and gives keys and figures. An introduction, by Williams, gives ecological notes, as does also his "Handbook" (1931, pp. 281-283). Preliminary studies were made of this group by Timberlake (V: 190, 1923). At present the family is represented in Hawaii by 48 species, divided among 12 genera. If the native species continue to be split as finely as in Van Duzee's recent paper, future collecting will bring to light a great many more. This is the largest family of Orthorhapha, and also one of the largest groups of native flies in these islands. Perkins (1913, p. clxxxiii) stated that "at least 100 species of this family might be procured in the islands."

Van Duzee (VIII: 310, 1933) described *Chrysosoma fraternum* for the species known by Grimshaw (1901, p. 11; 1902, p. 80) and others as *Gnamptopsilopus* or *Psilopus patellifer,* Bezzi (1928, p. 66) having pointed out that the Hawaiian species was different from the Guam species described by Thomson (1868). It is common in parts of the main islands, and was also collected on Midway and Cure Islands (Bryan, 1926, p. 67). A related species,

Chrysosoma pallidicornis, was described by Grimshaw (1901, p. 12, pl. I: 20-21) in the genus *Gnamptopsilopus,* the change of genus being given by Bezzi (1928). Van Duzee (1933) gave a key for separating these and related species. A good figure of *C. fraternum* (née "*patellifer*") was given by Williams (1931, p. 282). Perkins (1913, p. clxxxiii) said that "*patellifer*" had been long established, but that *pallidicornis* was first noticed in 1896, more common in 1902, and still more common in 1913. At present it is only occasionally seen, although at times specimens come into houses and may be caught on windows. Both species breed in soil in which plants are being propogated.

An Australian species, *Sciapus pachygyna,* which is found in the lowlands and in sugar cane fields, was determined by Knab (Swezey, III: 272, 1917).

Campsicnemus is represented by 27 species: three described and figured by Grimshaw in 1901 (pp. 13-14) and one in 1902 (p. 80); three by Malloch (1932); and twenty by Van Duzee (1933). Grimshaw (1901, pp. 15-16) also described three species of *Chrysotus,* and Van Duzee (1933) two other new species.

A small, flightless species was described and figured by Grimshaw (1902, p. 81) as *Emperoptera mirabilis,* new genus and species. Perkins (I: 49, 1906 and 1913, p. xlviii) stated that it was "locally common" on Tantalus, Oahu, but specimens are seldom collected.

Van Duzee (1933) described a species of *Syntormon;* three of *Medetera;* three species of the new genus *Eurynogaster;* one of the new genus *Sweziella;* and one of *Hydrophorus,* which is close to *H. praecox,* a name given by Aldrich to specimens collected on Laysan (Bryan, 1926, p. 67). On the main islands *Hydrophorus* breeds in mud flats and feeds on bloodworms (Williams, VIII: 213, 1933). *Medetera femoralis* Becker was thought to occur in Hawaii (Bryan, VII: 401, 1931). *Lianculus metallicus,* a large metallic green species described by Grimshaw (1901, p. 13) is occasionally collected. Williams (December 7, 1933) reported it from Molokai.

Dolichopus exsul, described by Aldrich (1922) and noted by him as the "only tropical species of the genus" (Bryan, V: 285, 1923), is exceedingly abundant locally in moist places in valleys

and the lower rain forest. It will probably be found on all the main islands of the group.

P. H. Timberlake (V: 190, 1923) and F. X. Williams have done much to advance the knowledge of these interesting "long-legged" flies, many of which are water skaters or found associated with water in both lowlands and native forest. Perkins (1913, p. clxxxiii) gave interesting observations on their habits.

Aldrich gave the name *Paraphrosylus* sp. to specimens from pools of salt or brackish water on Nihoa, Necker, French Frigates Shoal, Lisiansky and Wake Islands (Bryan, 1926, p. 68).

Family PHORIDAE

This family is much in need of investigation. Some undetermined species have been sent to Professor Brues for identification, and still others are being caught from time to time. The following have been recorded:

"*Phora* sp." of Grimshaw (1901, p. 76), Pemberton (IV: 1, 1919), and Bryan (IV: 489, 1921), bred from decaying pineapples and landshells, was determined by Knab (Bryan, V: p. 291, 1923) as the American species, *Aphiochaeta scalaris* (Loew). Bezzi (1928) stated that the cosmopolitan *A. xanthina* had been bred from diseased pineapple suckers from Hawaii. These may or may not be the same species. It was reported by Illingworth (V: 268, 277, 1923) as "bred abundantly from cutworm material;" and what was considered to be this species was collected on Lisiansky Island and Pearl and Hermes Reef (Bryan, 1926, p. 67).

Malloch (1912) described *Aphiochaeta setaria* from a single female collected on Maui.

Specimens bred from rotten potatoes by Illingworth were determined by Knab as *Conicera atra,* (Bryan, V: p. 290, 1923) although they do not seem to agree with Brue's description and figure (1906, p. 7, pl. I: 4).

An undetermined species of *Puliciphora* was also found (Bryan, V: 292, 1923).

Family LONCHOPTERIDAE

A specimen of *Lonchoptera* collected by W. M. Giffard near Kilauea, Hawaii, in 1922 (Bryan, V: 347, 1924); a series col-

lected on Molokai (Swezey and Bryan, VI: 415, 1927); and 14 specimens from Hawaii (Swezey and Williams, VIII: 188, 1932) may belong to *Lonchoptera furcata* or a new species.

Family PIPUNCULIDAE

Species of Pipunculus have attracted attention in Hawaii, not only because of their striking appearance, the heads being large and nearly covered with the eyes, but also because of their economic importance. They are parasites on delphacid leafhoppers, including the sugar cane leafhopper, *Perkinsiella saccharicida,* which has been one of Hawaii's major sugar cane pests.

Grimshaw (1901, pp. 17-18) described three species. Perkins (1905) described five more, with an account of their habits; later (1910) he described four more; and 1913 (p. clxxxiii) he gave further notes on habits. Accounts of the relation between these flies and the sugar cane leafhopper were given by Perkins (1903, p. 23 and 1905), Swezey (I: 17, 1906), Rosa and Timberlake (IV: 7, 12, 38, 1919), and Williams (IV: 68, 1919, fig.). Swezey (II: 160, 1912) suggested that *P. swezeyi* is a parasite of *Nesosydne pipturi,* a native leafhopper on *Pipturus albidus,* the "mamaki" tree. Williams (VI: 446, 1927) noted that they are preyed upon by Crabronidae.

Family SYRPHIDAE

Several species of "drone" or "hover" flies are known in Hawaii, all believed to be immigrants, and, according to Perkins (1913, p. clxxxiv) of rather recent introduction.

Volucella obesa was recorded by Grimshaw (1901, p. 19), and was called "abundant everywhere" on the island of Hawaii in 1905 by Swezey (I: 17, 1906). Today this brilliant metallic green hovering fly is among the most abundant lowland species in Hawaii, and is widespread in the Pacific. Its larvae feed on decaying vegetable matter. Weinrich (I: 25, 1906) recorded the larvae breeding in sisal juice; Illingworth (III: 83, 1915 and VII: 252, 1929) in a papaya trunk; and Williams (VIII: 233, 1933) in filter-press mud. An illustration and description were given by Williams (1931, pp. 284-6).

Volucella pusilla was first collected on Oahu in the fall of 1930 (Swezey, VII: 393, 1931), and soon became abundant on that island. It will doubtless find its way to the lowlands of all the islands. It has been found breeding in cactus stems (Swezey, VIII: 28, 1932). It, like *V. obesa*, is attracted to opening buds and blossoms.

Ischiodon scutellaris was recorded (as *Xanthogramma grandicornis*) by Howard (1901) and Grimshaw (1901, p. 19, pl. 2: 7-10). Its value as a predator on aphids has been discussed by Swezey (I: 17, 1906), Kirkaldy (I: 100, 1907), Kotinsky (1907, p. 77), Fullaway (1909, p. 25), and Timberlake (VI: 530, 1927, pl. XIX, fig. 3). Life-history notes were given by Terry (1906, p. 39). It is parasitized by *Pachyneuron allograptae* (Ashmead) (see Timberlake, III: 403, 1918 and V: 424, 1924), and by *Diplazon laetatorius* (Fabricius) (see Swezey, VII: 282, 1929). The name *Simosyrphus grandicornis* was suggested by Curran; and *Ischiodon scutellaris* by Bezzi (1928) in recording it from Fiji, (see Bryan, VII: 401, 1931) and Hull (1929) from Samoa. It is abundant in the lowlands of Hawaii; found on Johnston and Wake Islands (Bryan, 1926, p. 68); and is widespread in the Orient, Australasia, and Oceania.

Allograpta obliqua was first collected on corn infested with *Aphis maidis* in 1920 (see Timberlake, IV: 456, 1921), and on Kauai the same year (Swezey, IV: 521, 1921). By 1922 it had spread to both ends of the main Hawaiian group, which suggests that the date of its first arrival may have been several years earlier, (see Swezey, V: 186, 1923, and Giffard, V: 196, 1923). It is a valuable predator on aphids, and has also been bred from a mass of *Pseudococcus virgatus* (see Swezey, VI: 226, 1926, and VII: 181, 1928). It becomes locally abundant throughout the islands, especially in corn patches infested with *Aphis maidis*. It is parasitized by *Diplazon laetatorius* (Fabricius) (see Swezey, VII: 282, 1929).

Toxomerus marginatus was first recorded by Swezey (April 6, 1933), specimens having been collected March 20, 1933, at flowers in Kalihi, Oahu; and on Kauai, June, 1932.

Eristalis tenax was recorded by Howard (1901) and Grimshaw (1901, p. 19), and has been mentioned in several notes and lists. It is comparatively rare, except at higher elevations on the island of Hawaii. The larvae, popularly known as "rat-tailed maggots," have been bred from decaying organic matter. The species is nearly cosmopolitan, and has probably been in Hawaii for many years.

Lathyrophthalmus arvorum (formerly called *Eristalis punctulatus*) was recorded by Grimshaw (1902, p. 82). Swezey (I: 17, 1906) called it "very abundant" on the island of Hawaii in 1905. It has been mentioned in several notes and lists. The larva was described by Terry (1906, p. 39). Bridwell (IV: 360, 1919) recorded it as breeding in pineapple and sisal refuse; Illingworth (V: 280, 1923) stated that the adults were attracted to carrion; and Williams (VIII: 233, 1933) bred it from filter-press mud. Synonomy was suggested to the writer by C. Howard Curran. This species is widely distributed in the Indo-Malayan and Australasian regions, and it is one of the most common lowland flies in Hawaii.

Lathyrophthalmus aeneus was first collected in Honolulu in the fall of 1919, and was reported (as *Eristalis aeneus*) by Osborn (IV: 329 and 339, 1920) and Bryan (IV: 360, 1920). It is thought to have immigrated here from the Pacific Coast of America about 1918 or 1919, for it became suddenly very abundant on Oahu, hibernating during the winter of 1919-20 in out of the way places. Swezey (VIII: 10, 1932) reported it from Molokai. Illingworth (V: 280, 1923) noted it as attracted to carrion. It is widespread in Europe and North America.

Eumerus marginatus was described by Grimshaw (1902, p. 82). His suspicion that it might not be endemic was strengthened by the capture of specimens thought to be this species in 1907 in South China and 1909 in Amboina by Muir (Terry, II: 91, 1910). Curran, however, thought that these Asiatic specimens may belong to a closely related species, of which there are several. This species is found in many parts of Hawaii, but nowhere abundant. Another species of *Eumerus* was reported taken in Honolulu by Swezey (January 5, 1933). Pemberton (July 6, 1933) reported the col-

lection of a new *Eumerus* sp. with conspicuous white posterior tarsi in Honolulu, June 10, 1933.

Syritta oceanica was recorded by Howard (1901) and Grimshaw (1901, p. 19). Terry (II: 96, 1910) gave notes on its life-history. It is found throughout Hawaii, especially about Compositae, but nowhere very abundant. It also occurs in Fiji (Bezzi, 1928).

Euplodes volucris, Syrphus americanus and "possibly other species" were introduced and liberated in 1919 (Osborn, IV: 333, 1920), but apparently they did not become established. *Eumerus strigatus* and *Mirodon equestris* were bred from daffodil bulbs imported from California (Whitney, IV: 606, 1921), but apparently have not become established. *Melanostoma stegnum* (Say) was intercepted in Quarantine, in 1921 (Whitney, V: 3, 1922). *Syrphus opinator* Osten Sacken was bred, December 31, 1924 (Swezey VI: 220, 1926), from a puparium found in celery imported from California, but it is not known to be established.

Family OESTRIDAE

The "sheep head-maggot" or "bot fly," *Oestrus ovis,* was recorded by Grimshaw (1901, p. 20), and subsequently noted by Terry (1906, p. 43), and Van Dine (1908, p. 47 and 1909, p. 36). Van Dine and Norgaard (1908, p. 62) gave an account of its habits and control. The viviparate larvae, deposited within the nostrils of sheep, work up into the frontal sinuses where they attach themselves, feed upon mucous membrane and secretions, and cause great irritation. The full fed larvae are sneezed out and pupate in the soil. Maggots have also been found in the sinus of a goat, killed on Kauai (Fullaway, V: 365, 1924). This cosmopolitan sheep pest seems to be definitely established in Hawaii, although not abundant.

Hypoderma lineata was first recorded (as *Hypoderma* sp.) by Terry (1906, p. 43) and subsequently noted by Van Dine (1908, p. 47 and 1909, p. 36), and Swezey (V: 10, 1922). Van Dine and Norgaard (1908, p. 40) gave notes on habits and control. Ehrhorn (III: 113, 1916) thought the flies were controlled on Molokai by ants (*Pheidole magacephala*) which destroy the

larvae as they fall to the ground to pupate. This "heel fly" has doubtless been imported several times with shipments of cattle. There are occasional outbreaks on ranches on Kauai, Molokai, and Hawaii, but the species is not abundant. (See Swezey, VI: 360, 1927; Illingworth, VI: 373, 1927; and Pemberton, VIII: 242, 1933).

There are no specimens or definite records to prove the presence of the "warble fly," *Hypoderma bovis* De Geer. It was doubtfully recorded by Van Dine (1908, p. 47) and this record has been repeated.

Family TACHINIDAE

Seven exotic, immigrant species are known in Hawaii, all of which are useful parasites.

Chaetogaedia monticola was recorded from Hawaii (as *Blepharipeza*) by Bigot (1888, p. 91), with records by Coquillett (1897, p. 137), Grimshaw (1901, p. 20, and 1902, p. 83), Terry (1906, p. 40) and numerous later records. Notes on its interesting and peculiar habits and life-history are given by Swezey (I: 49, 56, 1907; I: 163, 1908; II: 7-9, 1908; 1909, p. 25; II: 160, 162, 1912), and Illingworth (V: 277, 1923). It is a valuable parasite on cutworms and armyworms, a list of its many hosts being given by Swezey (1909, pp. 25-30, and VI: 356, 1927). It is parasitized by *Chalcis obscurata* Walker, and is a "favorite prey of the larger Hawaiian Crabronidae" (Perkins, 1913, p. clxxxv). This North American species is generally distributed throughout the main islands of the group, even occurring in the native forest. Like certain other abundant flies, it has been blown to the tops of the high mountains (Bryan, VI: 282, 1926, and Swezey and Williams, VIII: 191, 1932). Swezey (September 7, 1933) recorded it from Haleakala, Maui, 7000 feet.

Frontina archippivora is said to have been introduced from North America by Koebele to help control armyworms. Notes on its life-history, habits, hosts, and distribution are given by Swezey (1907, pp. 46, 56; 1909, p. 25; V: 8, 1922; V: 184, 303, 1923). It, also, has been found on top of the high mountains (Bryan, VI: 282, 1926); is widespread in the lowlands of the main islands; and a single specimen was captured on the summit peak of Nihoa Island (Bryan, 1926, p. 68).

Archytas cirphis was described by Curran (VI: 497, 1927) for a species introduced by the Hawaiian Sugar Planters' Association from Los Mochis, Mexico, in February, 1924 (see Swezey VI: 226, 1926, and 499-503, 1927). It quickly became established on all the larger islands of the group, and is rapidly becoming one of the most abundant flies in the lowlands. It is a valuable parasite on caterpillars, being known as the "Mexican tachinid armyworm parasite." (See: Muir, VI: 354, 1927; Swezey, VI: 359, 1927; Illingworth, VI: 395, 1927; Williams, VII: 10, 1928; Swezey, VII: 11, 1928; Pemberton, VII: 210, 1929; and Swezey, VII: 340, 1931).

Leucostoma aterrima was recorded (unidentified) by Bridwell (IV: 339, 1920) as bred from *Corizus hyalinus* on Ewa Coral Plain, Oahu, October, 1919; and by Swezey (IV: 467, 1921) as bred from the same host at Puuloa, Oahu, March 24, 1920. In 1921 it was determined by Aldrich as *Leucostoma atra* Townsend, a common American species. In 1932 Aldrich corrected this identification to *L. aterrima,* and stated that the *Leucostoma analis* (Meigen), doubtfully recorded by Grimshaw (1901, p. 20) was a synonym, (see also Illingworth, V: 268-9, 1923). The "small unidentified littoral species" of Perkins (1913, p. clxxxiv)may also be *L. aterrima.*

Leucostoma atra was also identified by Aldrich from specimens collected on Oahu in 1920 by Williams. Characters are given by which this species and *L. aterrima* may be separated (Swezey, VIII: 242, 1933.)

Microceromasia sphenophori was described (as *Ceromasia*) by Villeneuve (1911, p. 81) for a New Guinea species, introduced into Hawaii by F. Muir in 1910, and later into Fiji (Illingworth, 1913, and 1914, p. 390) and into Samoa from Hawaii, as a parasite on the sugar cane beetle borer, *Rhabdocnemis obscura.* Good accounts of the dramatic introduction of this fly, and its habits, are given by Muir and Swezey (1916, and VIII: 143, 1932); Timberlake (VI: 540 ff. pl. XXI, 1927); and Williams (1931, pp. 294-6); with numerous other references in the publications of the Hawaiian Sugar Planters' Association. It attacks the grub of the beetle, both in sugar cane and in coconut palms (Swezey,

III: 380, 1918). The puparium is parasitzed by *Pachycrepoideus dubius* Ashmead (Timberlake, V: 424, 1924), and the ant, *Pheidole megacephala*, attacks the maggots (Illingworth, 1914, p. 396). Bezzi (1928, p. 209) records it from Fiji as *Microceromasia.*

Ochromeigenia ormioides was introduced from Formosa several times between October, 1926 and 1930, as a parasite on *Adoretus sinicus*, and liberated on Oahu, (Fullaway, Reports of the Entomologist, Hawaii Board of Agriculture and Forestry, 1926 to 1930), but, as none has been recovered, its establishment is doubtful.

Family SARCOPHAGIDAE

Six species of Sarcophaga, all immigrants and widespread, if not cosmopolitan, occur in Hawaii. Timberlake (III: 371-2, 1918) gave a key for their identification.

The largest species is *S. barbata*, originally described from Oahu by Thomson (1868, p. 533), but widespread in Europe and America. Grimshaw (1901, p. 26) reprinted the original description. Muir (V: 353, 1924) compared specimens with the type. Illingworth (V: 280, 1923) noted it as one of the first insects to approach dead animals. It and *S. dux* are parasitized by *Mormoniella brevicornis* Ashmead and perhaps other wasps (Timberlake, V: 421, 1924). It is widespread throughout the main Hawaiian islands, and was collected on Kaula Islet (Bryan, VIII: 245, 1933.)

Sarcophaga dux, also described from Honolulu by Thomson (1868), and listed by Grimshaw (1901, p. 27), has been shown by Parker (1919, pp. 41-46) to be almost cosmopolitan. He divided the species into seven subspecies, of which two (*dux* and *harpax*) were said to occur in Hawaii. *Dux* is the more common here, occurring also in Guam and the Philippines; *harpax*, which is widespread in Europe, Japan, Formosa, the Philippines, and the United States, is here rarely seen. Muir (V: 353, 1924) compared specimens with the type in Stockholm. Bezzi (1928, p. 190) reported it from Fiji and Buxton (1929) from Samoa. Its maggots were found in carrion (Illingworth, V: 280, 1923).

Sarcophaga fuscicauda was first collected by Terry in 1905, and was determined for Timberlake (IV: 256, 1920) by R. R.

Parker. It is the "Sarcophaga sp." of Timberlake's key (III: 371, 1918). It was shown by Illingworth (VI: 262-5, 1926) to have been widespread by commerce from a center somewhere in southeastern Asia, having been described by Böttcher (1912, p. 168) from Formosa. Bezzi (1928, p. 191) recorded it from Fiji and Buxton (1929) from Samoa. Illingworth (V: 266, 1923) noted it as the most abundant fly in hen manure, and one closely associated with man in the tropics. He recorded its pupa being parasitized by *Eucolia impatiens* Say, a wasp introduced from Arizona in 1906 (see Swezey, V: 303, 1923).

Sarcophaga haemorrhoidalis is comparatively rare in Hawaii, breeding in human excrement. It occurs in Europe, Asia, and Africa, and is a common scavenger in North America, whence it probably came to Hawaii. On Kauai it was reported by Swezey (III: 379, 1918) as attracted to sugar cane juice. On Molokai it was found about excrement in pineapple fields (Illingworth, VI: 395, 1927).

Sarcophaga pallinervis, described by Thomson (1868, p. 535) and listed by Grimshaw (1901, p. 26), is probably the most common sarcophagid in Hawaii, breeding in cow dung and dead animals on all the main islands (see Van Dine, 1908, p. 47). It is frequently mentioned in notes and lists in these "Proceedings." It is widely distributed throughout the United States, where it is a common scavenger, formerly known as *S. communis* Aldrich. Its anatomy was exhaustively discussed by Parker (1914, p. 55). It is parasitized in Hawaii by *Aphaereta muscae* Ashmead (Bridwell, IV: 178, 1919). Williams (VI: 445, 1927) also noted that *Xenocrabro hawaiiensis* provisions its nests with it. It has been caught on the summits of Mauna Loa and Mauna Kea, Hawaii, (Bryan, VI: 282, 1926).

Sarcophaga plinthopyga (formerly known as *S. robusta* Aldrich) is a large North American species, somewhat rare in Hawaii. It breeds in meat (Illingworth, III: 383, 1918 and VI: 239, 1926).

A good résumé of Hawaiian sarcophagids is given by Williams (1931, pp. 297-9).

An entirely distinct species (still undetermined) was found abundant and widespread on islets to the northwest of Kauai (Bryan, 1926, p. 68).

The two endemic genera, *Dyscritomyia* and *Prosthetochaeta,* placed by Grimshaw (1901) in the family Sarcophagidae, are here considered under Calliphoridae (below).

Family CALLIPHORIDAE

In 1901 Grimshaw described two new genera, *Dyscritomyia* and *Prosthetochaeta,* for a group of endemic, robust, metallic blue-green, flies, found in the native forests of Hawaii. They produce living maggots and are thought to breed in the large land and tree snails (Perkins, I: 98, 1907; 1913, p. clxxxv; Terry, II: 179, 1912). Grimshaw placed them in the family Sarcophagidae. Following the limitation of the Sarcophagidae, as given by Aldrich (1916, p. 7), these two genera do not fall within that family. Their morphology and habits, rather, include them in the Calliphoridae, subfamily Calliphorinae, in which group the writer proposes that they be placed. Grimshaw based the genus *Dyscritomyia* on *limbipennis* which Thomson (1868, p. 541) described in the genus *Catapicephala. Prosthetochaeta* is distinguished from *Dyscritomyia* by characters so minor and so variable (some having intergradations) that it may seem desirable to combine the two. Grimshaw (1901, pp. 21-26) described four new species of *Dyscritomyia* and four of *Prosthetochaeta.* These flies are parasitized by *Aspilota konae* Ashmead (Bridwell, IV: 388, 1920); and they are preyed upon by Crabronidae (Perkins, 1913, p. clxxxvi, and Williams VI: 444, 1927). The following species is described as new:—

Dyscritomyia terryi n. sp.

Robust, bright metallic green species, with silvery pubescence on the orbits of the eyes. It resembles *D. hawaiiensis* and *D. limbipennis* in having the costal margin of the wing strongly infuscated; but it differs from them in being bright metallic green, with only the hind margins of the abdominal segments and parts of the head darkened, the other two species being dark bluish-green.

Head as broad or a little broader than the thorax, the front of the male ⅛, of the female ¼, the width of the head; eyes bare, the orbits more or less distinctly covered with silvery pubescence. Antennae dark brown, decumbent, nearly as long as the face, the third segment about four times as long as the second, covered with fine, golden pubescence; the second with a strong apical bristle and black hairs; the arista long, slender, plumose, with the hairs longer on the dorsal side, bare only on the apical ¼ or less.

The chaetotaxy agrees with that of the generic description, as follows:— In the male: 2 vertical bristles, parallel and pointing backward; and on each

side of the front a single row of fronto-orbital bristles, reaching from the vertex to base of antennae, the 3 or 4 nearest the vertex parallel and pointing backward, the others decussating in front view, erect when seen laterally. In the female: two inner vertical bristles, like those of the male, and two outer, shorter ones, pointing backward and outward; and fewer fronto-orbital bristles, with, near the vertex, two in an outer row, pointing forward. The vibrissae are very strong, crossing in front, located at the corners of a somewhat projecting oral margin. Below them, the sides of the mouth opening have a row of a dozen moderate bristles. Above them, the facial ridges on their lower half have a few small bristles, diminishing in size upwards.

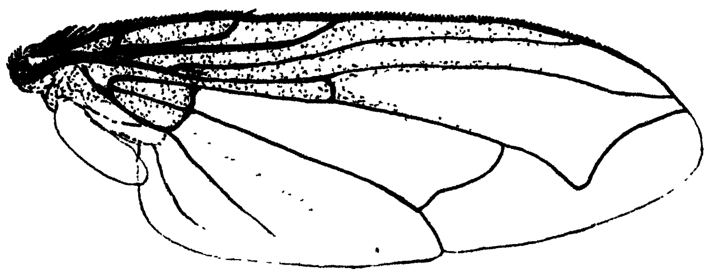


FIG. 1. *Dyscritomyia terryi* n. sp., wing.

The proboscis and palpi are a dark purplish brown, some parts with a golden pubescence or sheen, with numerous short black bristles and fine hairs; tip of the proboscis with whitish hairs. Cheeks dark shining brown, or in some specimens, dark blue or greenish, with numerous stiff black hairs and slender bristles. Posterior orbits with silvery pubescence, edged with a single continuous row of uniform short black bristles, behind which are scattered rows of similar bristles on the more or less silvery surface, continuous with the longer hairs and bristles of the cheeks.

Dorsum of the thorax bright metallic green, with small black bristles and, as prescribed for the genus, the following macrochaetae on each side: 2 humeral, 1 posthumeral, 1 weak and 2 strong dorsocentral before the suture, and 3 behind the suture, 2 acrostichal before the suture and 1 between the hindmost dorsocentrals, 2 intra-alar, 3 supra-alar, and 1 presutural, which lies lower than the posthumeral. The scutellum is concolorous with the thorax, with the following bristles: 3 strong pairs of lateral, 1 pair of dorsal, and 1 pair of smaller apical, which cross.

Sides of the thorax concolorous, with the following macrochaetae: 7 strong mesopleural, 1 strong notopleural in line with them, 2 very strong and 1 moderate sternopleural, a row of 7 moderately strong hypopleural, and numerous other small bristles and stiff hairs, especially near the coxae.

Abdomen concolorous with the thorax, except that the hind margin of each segment (about 1/5th the width of each) is dark, shining steel blue. The median dorsal line is marked by pairs of bristles as follows: on the margin of the 1st segment (small), disc and margin of 2nd, disc and margin of 3rd, disc and margin of 4th, reaching their greatest size on the margin of the 3rd, and diminishing both ways. The margins of the 3rd and 4th

have a continuous row of strong bristles, and there are also bristles on the sides of the 1st and 2nd segments. The terminal segments also are crowned with smaller bristles.

Legs slender, blackish-brown, the femora with greenish reflections; covered with small black bristles, and with moderately strong macrochaetae, especially tufts of them on the apicocephalic aspect of the coxae, rows on the femora, scattered bristles on the tibia, and an apical circlet on each segment. Claws and pulvilli are fairly strong.

Wings with venation as shown in figure 1. Costal margin, as far as the tip of vein R_{2+3} and as deep as the media, to the r-m crossvein and the basal cells, strongly infuscated; not so strongly as in specimens of *D. hawaiiensis*, but fully as strongly as in *D. limbipennis*, with somewhat its yellowish tinge toward the base. Halteres and alulae lacy white, with yellowish margin fringed with fine, short, golden hairs.

Length:—9 to 11 mm.; wing, 7 to 9 mm.

Type: (male) Mt. Olympus, Oahu, V-18-1919 (J. A. Kusche); (female) Opaeula, Oahu, 3-30-13, (O. H. Swezey). Paratypes: 20 males and 9 females, all from Oahu, the distribution being from Palolo on the east to Opaeula on the west, and the earliest specimen having been collected by Terry in 1906.

Phormia regina was recorded by Howard (1901), repeated by Grimshaw (1901), the specimens having been collected on the island of Hawaii (see Bryan, V: 347, 1924). It has been collected only twice since, both on Hawaii (Swezey and Williams, VIII: 188, 192, 1932).

One of the most abundant species of this family in Hawaii is the "sheep maggot fly," *Chrysomyia megacephala*. It was formerly known here as *Lucilia*, *Pycnosoma*, or *Chrysomyia dux*, a determination made by Townsend (see Swezey, III: 272, 1917). It was considered to be of some economic importance and has been discussed by Van Dine and Norgaard (1908, p. 43), Van Dine (1908, p. 47 and 1909, pp. 21, 36), Kuhns (III: 267, 1917), Bridwell (1918), and Illingworth (III: 429, 1918; V: 280, 1923 and 377, 1924; VII: 252, 1929). Illingworth (V: 266, 1923) gave the synonymy, distribution, and habits of this species, and (VI: 254-5 and 266, 1926) a bibliography of references to it in Hawaii, and further notes on distribution. Timberlake (V: 421, 1924) noted *Mormoniella brevicornis* Ashmead as a pupal parasite. Bezzi (1928, p. 187) recorded it from Fiji.

Chrysomyia rufifacies was first reported by Illingworth (III: 429, 1918), being called by him the "common sheep maggot fly of

Australia." It has been reported here as *C. albiceps*, but the careful study of Holdaway (1933) seems to indicate *rufifacies* as the correct name. Bezzi (1928, p. 187), recording it from Fiji, also gives preference to this name. The maggots dominate carcasses in which they breed (Illingworth, V: 280, 1923).

The "English bluebottle fly," *Lucilia sericata*, was recorded and considered of economic importance by Van Dine and Norgaard (1908); Van Dine (1908, p. 47 and 1909, p. 36); Swezey (III: 273, 1917) for whom it was determined by Townsend; Bridwell (1918); and Illingworth (III: 370, 1918; V: 272 and 280, 1923). It has been fairly common locally in parts of the main group, and was found abundant on Kaula Islet (Bryan, VIII: 245, 1933) and Nihoa Island (Bryan, 1926, p. 69). The pupae are parasitized by *Mormoniella brevicornis* Ashmead (Timberlake, V: 421, 1924), and the adults captured and stored in the nests of Crabronidae (Williams, VI: 446, 1927).

Although listed by Howard (1901), which record was repeated by Grimshaw (1901), Van Dine (1908) and others, *Lucilia caesar* probably does not occur in Hawaii, as has been pointed out by Illingworth (V: 267, 1923), these records probably being based on a misidentification of *Lucilia sericata*.

An endemic species of *Lucilia*, *L. graphita*, was described by Shannon from the small islets to the northwest of Laysan (Bryan, 1926, pp. 69, 72; VI: 236, 1926; VIII: 3, 1932).

Calliphora or *Protocalliphora azurea* was reported by Grimshaw (1901, p. 27). Illingworth (V: 268-9, 1923) pointed out that this may have been a misidentification of *Chrysomyia megacephala*, for no specimens have been collected since.

Howard (1901) and Grimshaw (1901, p. 27) record *Calliphora vomitoria*. This large bluish blowfly is occasionally seen, especially at higher elevations (Swezey and Williams, VIII: 191, 1932). The closely related, smaller blowfly, *Calliphora latifrons*, was reported by Illingworth (V: 277, 1923) and Bryan (V: 290, 1923), the determinations having been made by Aldrich. This may be the species to which belong two damaged specimens referred to by Grimshaw (1901, p. 28).

Rhinia testacea, an Oriental species, was recorded by Grimshaw (1902, p. 83), which record was questioned by Illingworth

(V: 268, 1923). Bezzi (1928, p. 188) recorded it from Fiji. (See Malloch, 1926).

Stomorhina pleuralis, described as *Idia* by Thomson (1868), is locally abundant in dry localities in the lowlands. It was recorded by Howard (1901), repeated by Grimshaw (1901, p. 28). Bridwell (III: 12, 1914) recorded its egg-laying habit.

Perkins (1913, p. clxxxvii) stated that *Chrysomyia megacephala ("Pycnosoma dux"), Lucilia sericata,* and *Rhinia testacea* first appeared in Hawaii about 1900.

Family GASTROPHILIDAE

Gastrophilus intestinalis has been recorded (as *G. equi*) by Terry (1906, p. 43), and Van Dine (1908, p. 47 and 1909, p. 36). Swezey and Williams (VIII: 188, 1932) bred a specimen on Hawaii. Life-history notes were given by Van Dine and Norgaard (1908, pp. 66-69). A good account of habits, life-history, synonymy, and control was given by Dove (1918). At certain times this "horse bot-fly" has and may become locally abundant about stables and ranches throughout the islands.

The "chin fly," *Gastrophilus nasalis,* was recorded by Van Dine (1908, p. 47 and 1909, p. 36), with a note by Van Dine and Norgaard (1908, p. 69). A good account of its synonymy, habits, life-history, and control was given by Dove (1918). This species has been confused with the larger and more common *G. intestinalis,* but a few specimens have been found on ranches throughout the islands. Bezzi (1928, p. 185) recorded it from Fiji.

Family MUSCIDAE

The four representatives of this family in Hawaii are immigrants, three of them being very undesirable ones.

The horn fly, *Lyperosia irritans,* (also called *Haematobia serrata* or other combinations of these four names) was first recorded in Hawaii by Koebele, in 1898, (see Swezey, VII: 360, 1931). Perkins (1913, p. clxxxvii) believed that it arrived about 1896. It was recorded or discussed by Howard (1901), Grimshaw (1901), Kirkaldy (1905), Terry (1906, p. 41), Van Dine and Norgaard (1908), Terry (II: 193, 1913), Bridwell (1918), Wil-

liams (1931, p. 300), and various other notes in publications of the Hawaii Agricultural Experiment Station and Board of Agriculture and Forestry. It is abundant in the lowlands, especially about cattle, and even occurs at high elevations (Bryan, VI: 282, 1926). Several parasites have been found or introduced to control it: *Spalangia hirta* Haliday (Kotinsky, I: 31, 1906); *Eucolia impatiens,* (Kotinsky, I: 83, 1907 and 171, 1908, Craw, 1907, figure); *Spalangia philippiensis* Fullaway (III: 292, 1917, fig.); *S. cameroni* Perkins, and *S.* sp. (Timberlake, V: 426, 1924).

The stable fly, *Stomoxys calcitrans,* first reported by Howard (1901) and Grimshaw (1901), but noticed in numbers as early as 1892 (Perkins, 1913, p. clxxxvii), has also been of some little economic importance to cattlemen. Notes concerning this cosmopolitan species have been given by the same writers as concerning the horn fly, above. Bezzi (1928, p. 184) records it from Fiji, and Malloch (1929, p. 175) from Samoa.

The house fly, *Musca domestica,* is present, although seldom sufficiently abundant to be much of a nuisance. It was first reported by name by Howard (1901) and Grimshaw (1901), who also reprinted Thomson's description of *Musca flavinervis,* a variety of which was credited to Hawaii (1868, p. 547). It has been noted in the same references with the horn fly and stable fly (above). Males of this species found in Hawaii have the front narrower than those of typical *M. domestica,* which led Illingworth (V: 275, 1923, pl. ix and VI: 238, 1926) to regard it as the "oriental house fly." *Musca vicina* (= *M. flavinervis*), the synonymy after Patton (see Bryan, V: 364, 1924 and Patton and Senior-White, 1924). More recent authorities regard *M. vicina* as only a variety (Bezzi, 1928, p. 183) and Malloch (1932, p. 203), or as not at all distinct from *M. domestica* (Malloch, 1929, p. 174) (see Bryan, VII: 403, 1931). The adults are preyed upon by *Xenocrabro* (Williams, VI: 444, 1927); and Illingworth (1913 and III: 24, 1914) suggested that *Pheidole megacephala,* the common brown ant, is a large factor in controlling house flies in Hawaii. It is parasitized by *Spalangia cameroni* Perkins (Timberlake, V: 426, 1924). Other parasites are suggested by Illingworth (V: 273, 1923).

Synthesiomyia nudiseta was first recorded (as the "red-tailed Sarcophaga") by Bridwell (III: 15, 1914), who noted the interest-

ing habit of the larvae of making cocoons in the sand in which to pupate. Terry had reared it on meat as early as 1910. Illingworth (V: 180, 1923) in commenting on how the larvae make masses of pupal cases from rat hair, when breeding in dead rats, called the species *S. brasiliana*. This was corrected to *S. nudiseta* on the authority of Major W. S. Patton (see Illingworth, V: 265, and 280, 1923; and Bryan, V: 292, 1923). Bridwell (1918) gave notes on its habits. It was fairly common for a time, but is at present rare in Hawaii. Bezzi (1928, p. 179) recorded it from Fiji, Malloch (1929, p. 174) from Samoa, and Bryan (1926, p. 68) from Wake Island.

Family ANTHOMYIIDAE

This is one of the largest families of Hawaiian flies, containing besides the 37 native species of *Lispocephala* (formerly *Coenosia*) about 16 species, most of which are immigrants.

Hydrotaea houghi was identified by Malloch from specimens collected, 1919 and 1922, on Hawaii (see Bryan, V: 290, 1923). An undescribed species was listed by Grimshaw (1901, p. 29).

Ophyra nigra was identified for Swezey (III: 272, 1917) by Knab. Illingworth bred it from dead rats (V: 266 and 280, 1923), and from hen manure (V: 271, 1923). Bezzi (1928, p. 176) recorded it from Fiji, Malloch (1929, p. 169) from Samoa, and Illingworth (VI: 260, 1926 and VI: 401, 1927) from Japan and California. Williams (1931, p. 301) gives a brief description and note. *Ophyra chalcogaster* was determined by Aldrich (see Bryan, VI: 353, 1927). It was also recorded from Cure Island (Bryan, 1926, p. 69); from Samoa (Malloch, 1929) and from the Marquesas and Society Islands (Malloch, 1932, p. 196). *Ophyra aenescens* (Wiedemann), recorded by Grimshaw (1901, p. 30), may not occur in Hawaii (see Illingworth, V: 268, 277, 1923). *Ophyra leucostoma* (Wiedemann), recorded by Howard (1901) and Grimshaw (1901, p. 30), has also not been seen since, and may not occur here (see Illingworth, V: 268, 1923). Malloch (1929, pp. 169-170) gave a note on the separation of these species.

Limnophora arcuata was recorded by Illingworth (V: 188, 1923) as first collected in April, 1922, in Kaimuki, Oahu, and was

determined by Aldrich (see Bryan, V: 286, 1923). It is now very abundant in the lowlands, hovering in shady places. Malloch (1920) made this spécies the type of a new genus, *Eulimnophora*. Willaims (1931, p. 302) gave a brief note, stating that it is parasitized by a tiny wasp, *Spalangia cameroni* Perkins, (see Swezey, V: 356, 1924; Timberlake, V: 426, 1924). It was collected on the summit of Mauna Loa (Bryan, VI: 282, 1926).

Fannia canicularis was reported by Howard (1901) and Grimshaw (1901, p. 30), both as *Homalomyia*. Illingworth (V: 276, 277, 1923) found this "little housefly" abundant at Waimea, Hawaii, and it has been collected at various places since, including Cure Island (Bryan, 1926, p. 69). It occurs in North America and Australia. *Fannia pusio* was recorded and its life-history discussed by Illingworth (III: 271, 1917); and he also recorded it from hen manure (V: 271, 1923) and dead rat (V: 280, 1923). Malloch (1929, p. 156) recorded it from Samoa. Both these species were mentioned by Williams (1931, p. 301). *Fannia (Homalomyia) femorata*, recorded by Grimshaw (1902, p. 84), has not been seen since, and Illingworth (V: 268, 1923) considered it a possible misidentification.

Euryomma peregrinum (Meigen) was determined by Malloch, specimens from Oahu.

Two species of *Lispe* were described by Grimshaw (1901, pp. 30-31). These frequent the forest and are preyed upon by Carabidae (Perkins, 1913, p. clxxxvii); and neither has been recaptured. A single specimen of *Lispa metatarsalis*, described by Thomson (1868, p. 562), was captured by Illingworth (identification by Aldrich), and other specimens collected by Ashmead at Kilauea, Hawaii, were also determined by Aldrich as this species (see Illingworth, VI: 224, 1926).

Grimshaw (1901, p. 42 and 1902, p. 84) described *Acritochaeta pulvinata*, which has been known locally as *Charadrella* sp. In 1922 Malloch synonymized this with *Atherigona excisa* (see Bryan, V: 291, 1923). Swezey (III: 3, 1914 and October 5, 1933) bred it from various decaying fruits. Illingworth (V: 280, 1923) noted it attracted to dead rat; and he (VII: 255, 1929) considered it to be a minor pest of pineapples, through its spreading rot in the fruits. Bezzi (1928, p. 171) considered the Hawaiian form to

be variety *trilineata* Stein (see Bryan, VII: 403, 1931). It was briefly discussed by Williams (1931, p. 301). Malloch (1929, pp. 157-8) suggested that it had been introduced into America and the Pacific Islands from the tropics of the Eastern hemisphere. Malloch (1932, p. 201) recorded it from the Marquesas.

Hoplogaster (?) *dubia,* described by Grimshaw (1901, p. 43) has not been retaken.

Of the 37 species of *Lispocephala,* 13 were described (as *Coenosia*) by Grimshaw (1901, pp. 32-40), and 24 by Malloch, together with a key (VII: 67-89, 1928). Perkins (1913, p. clxxxvii) thought that there might be as many as 100 species of these native anthomyiids in the wet forest, where they are carnivorous and are preyed upon by Carabidae. *L. dexioides* was reported by Williams (VI: 445, 1927) found in the nest of *Xenocrabro,* (see Swezey and Williams, VIII: 188, 1932).

Anthomyia bisetosa, conspicuous because of the black band across the grey thorax, was first recorded by Timberlake (IV: 266, 1920, and IV: 468, 1921). It was recorded on the island of Hawaii in 1927 (Swezey, VII: 13, 1928) and on Kauai in 1928 (Swezey, VII: 272, 1929). Whitney (V: 37, 1922) referred this species to *A. vicariens* Schiner, on the authority of Aldrich, but the determination as given by Illingworth and Bryan, following Indian literature, seems to be accepted. A good figure was given by Williams (1931, p. 302, fig. 136).

Hylemyia cilicrura was the identification given by Aldrich to the "corn seed maggot" or "root maggot," formerly known in Hawaii as *Phorbia fusciceps* (Zettersted) (II: 297, 1913 and Bryan, V: 291, 1923). It was bred from beets by Illingworth, and the larvae have been found in vegetable matter.

The "cabbage maggot," *Hylemyia brassicae* (Bouché) has not been found in Hawaii, its reported presence being due to a misidentification of *H. cilicrura.*

Family SAPROMYZIDAE

Malloch (VI: 383, 1927) described *Homoneura hawaiiensis* for specimens collected on Kauai, Oahu, Maui, and Hawaii. He thought that this might have been the species referred to by

Grimshaw (1902, p. 85) as *Sapromyza* species. It is the *Sapromyza* sp. collected by Illingworth at Waimea, Hawaii (Bryan, V: 291, 1923), and may be that collected by Swezey and Bryan (VI: 415, 1927) on Molokai. There may also be other species of Sapromyzidae in Hawaiian lowlands.

Family SCIOMYZIDAE

Sciomyza hawaiiensis, described by Grimshaw (1901, p. 43; 1902, p. 84) was thought by Perkins (1913, p. clxxxviii) to have been possibly an immigrant species. Aldrich determined specimens from Oahu and Hawaii as this species (see Bryan, VII: 336, 1931 and VIII: 27, 1932). This species is not related to *Chiromyia (Scyphella) flava,* as mistakenly suggested by the Editor in a footnote (VIII: 27, 1932). It is locally abundant in parts of Kauai, Oahu, Maui, and Hawaii, and may occur on all the main islands.

Family BORBORIDAE

Leptocera ferruginata was identified by Knab (see Bryan, V: 292, 1923) from material previously called *Borborus* sp. It is widespread in Hawaiian lowlands and very common about manure and decaying vegetable matter. Bezzi (1928, p. 161) recorded it from Fiji. It (or a related species) was found on Laysan, Lisiansky, and Midway Islands in 1923 (Bryan, 1926, p. 69).

Grimshaw (1901, p. 76) described *Limosina aequalis* and (p. 75) recorded *L. venalicia.* The latter species seems to be widespread in the lowlands, even getting up into the native forest, and being found on Laysan Island (Bryan, 1926, p. 69).

Borborus bilineatus was described by Grimshaw (1901, p. 75). Aldrich identified specimens from Kahoolawe as this species (Bryan, VIII: 230, 1933).

Family TETHINIDAE

Tethina insularis was described by Aldrich (VII: 395, 1931) for specimens collected on Pearl and Hermes Reef and Wake Island (Bryan, VII: 336, 1931). It will probably be found on other islands in this region.

Family ORTALIDAE

Seven species are known to occur in Hawaii, all of which are probably immigrants. Six are briefly discussed by Williams (1931, pp. 303-305, figs. 137, 138). Three of the genera are separated in a key given by Malloch (1932, p. 207). One species is as yet undetermined (see Swezey, VII: 236, 1929).

Chrysomyza aenea is a cosmopolitan, bright metallic green species with clear wings, fairly common in various parts of Hawaii. It was first recorded (as *Chrysomyza* sp.) by Grimshaw (1902, p. 85). Perkins (1913, p. clxxxviii) stated that it first appeared about 1900. Swezey (III: 12, 1914) recorded rearing it from maggots in cow manure. Fullaway (III: 142, 1916) reported finding a mass of the larvae breeding in horse and cow manure, and that about 50 per cent proved to be parasitized by Spalangia. Swezey (VI: 48, 1925) reported breeding it in filter-press cake on Maui. Williams (1931, p. 304, fig. 138) gave a good figure.

Grimshaw (1901, p. 44; 1902, p. 85) recorded *Euxesta annonae*, an American species. This "four-banded fly" was noted among the pests of sugar cane (Perkins, 1903, p. 27; etc.) because it bred in the galleries made by the sugar cane beetle borer, *Rhabdocnemis obscura*. But Williams (1931, p. 303, fig. 137) pointed out that it was there only as a scavenger. Severin and Hartung (1912) bred it from rotting bananas. Illingworth (V: 272, 1923) bred it from hen manure, and (V: 280, 1923) noted that it is attracted to carrion. He regarded it as a minor pest of pineapples, because it carries rot to abrasions on the fruits (VI: 385, 1927; VII: 255, 1929). Bezzi (1928, p. 88), in recording this species from Fiji, called it *Euxesta quadrivittata*. It is widespread in the lowlands of Hawaii, but is seldom common.

A single specimen of *Euxesta semifasciata*, described from the Ellice Islands by Malloch (1930, p. 216, fig. 1) was collected on Kauai by Dr. Hachiro Yuasa in 1932, the identification having been verified by Malloch.

Notogramma stigma, an American species, was first taken and recorded about 1912 by Severin and Hartung (1912), bred from decaying bananas. It was bred by Swezey (III: 4, 1914) from decaying fruits. It is collected occasionally in the lowlands.

Acrosticta pallipes, described by Grimshaw (1901, p. 44; 1902, p. 85) is now thought to be the same as *A. apicalis* (see Malloch, 1932, p. 206). Perkins (1913, p. clxxxviii) regarded it as a comparatively recent immigrant; Handel (1909) recorded it from South America; and Bezzi (1928, p. 89) from Fiji (see Bryan, VII: 402, 1931). Malloch (1930, p. 217) recorded it from Samoa and (1932, p. 205) from the Marquesas.

Scholastes bimaculatus was noted by Swezey (III: 272, 1917) as a coconut fly, described from Fiji, and occasionally found in Hawaii. It has been known here as *Paragorgopsis* sp. (Swezey, III: 70, 1915), the first specimens having been secured by Terry in 1904. The maggots, which breed in partly decayed, fallen coconuts, are whitish when young and deep blue when full-fed (Wilder, V: 365, 1924). This species is widespread in Polynesia (Swezey, V: 389, 1924; Bezzi, 1928; Malloch, 1930, p. 223).

Family TRYPETIDAE

The fruit and gall flies include two immigrant species of considerable economic importance, the melon fly, and the Mediterranean fruit fly; one large brown species, introduced from Mexico to help control the Lantana; and a very interesting group of two or more genera of endemic species on native Compositae.

The melon fly was described (as *Dacus cucurbitae*) by Coquillett (1899) from Hawaii, although it is an immigrant from the Asiatic tropics, thought to have arrived here about 1895. The first report of its presence was made by Clarke (1898); some publicity was given to it by Howard (1900 and 1901) and its description was reprinted by Grimshaw (1901, p. 45). Bezzi (1919) recorded it in the genus *Chaetodacus.* There exists a long series of accounts of its habits, activities, and control in Hawaii, of which the most important are two bulletins by Back and Pemberton (1917 and 1918), in which is a bibliography of earlier references. There are also accounts of its parasites by Pemberton and Willard (1918), Willard (1920), and Timberlake (V: 426, 1924). While still a pest of cucumbers, melons, gourds, and other cucurbitaceous plants, the melon fly is much less abundant than it was a few years ago, due to the activity of its parasites.

The Mediterranean fruit fly, *Ceratitis capitata,* was first reported in Hawaii in June, 1910 (Ehrhorn, 1910, p. 336; 1912). There is an even longer bibliography of accounts of the habits, depredations, and control of this fruit pest, good summaries of which may be found in Back and Pemberton (1918); Pemberton and Willard (1918, pp. 103-8); Willard (VI: 505-515, 1927); Timberlake (VI: 544, 1927); and Mason (VIII: 163-178, 1932). Introduction of parasites, begun in 1913 by Silvestri (1914), has been successfully accomplished. At present the United States Department of Agriculture, Bureau of Entomology, has a laboratory in Honolulu which is carrying on active researches on this fly. It has been found on all the main Hawaiain islands, as high as 6,000 feet elevation.

The Lantana gall fly, *Eutreta xanthochaeta,* was introduced from Mexico in 1902 by Koebele to help control the spread of *Lantana camara* Linnaeus (see Perkins and Swezey, 1924). Until about 1922 this species was confused with the North American "Solidago gall fly," *Eutreta sparsa* Wiedemann (see Bryan, V: 182, 1923 and VI: 364, 1927; Muir, V: 184, 1923). Aldrich (V: p. 261, 1923) described the distinct species. Its larvae make globular swellings, frequently seen on the spiny stems of the plant, but the fly is not often captured. It, like other gall flies, is used by native Crabronidae to provision their nests (Williams, VI: 445-446, 1926).

Phaeogramma vittipennis was described by Grimshaw (1901, p. 48), both genus and species being new. But one specimen has been taken since the original capture by Perkins. Williams (1931, pp. 305-6) gave a brief note.

Thomson (1868, p. 543) described *Trypeta crassipes.* Grimshaw (1901, pp. 45-48) placed this in the genus *Tephritis,* and described two new species, *T. cratericola* and *T. limpidapex. T. cratericola* has been collected from "silversword" and "greensword" (species of the endemic composit genus, *Argyroxiphium*) on Haleakala, Maui. *T. limpidapex* has not since been recognized.

In 1920 Bryan (IV: 475-480, 1921) reviewed these species and described two more, *T. dubautiae* (Terry's unpublished manuscript name) for a very small species found on *Dubautia,* and *T. swezeyi* for larger, quite distinct specimens, more like *T. limpidapex.* He also gave a key to these five species.

In 1922, at the suggestion of Aldrich, Bryan (V: 285, 1923) referred the three species with the star-shaped fuscous spot toward the apex of the wing (*crassipes, cratericola,* and *dubautiae*) to the genus *Trypanea* Shrank. After some correspondence with Bezzi regarding the correct genus for these species, Bryan (V: 367, 1924) decided to leave them in *Tephritis,* but in order to distinguish them from the more typical *Tephritis,* to place them in a subgenus, *Trypanoidea,* characterized by having both the reticulate fuscous wing pattern of *Tephritis* and the star-shaped apical wing spot of *Trypanea.*

Considerable more material belonging to this group, most of it bred from native composits by O. H. Swezey, will necessitate further revision and descriptions of new species.

Family PIOPHILIDAE

The "cheese skipper," *Piophila casei,* was first recorded in Hawaii by Grimshaw (1901, p. 48), with subsequent notes by Van Dine (1908, p. 48) and Swezey and Williams (VIII: 192, 1932). It is quite uncommon in Hawaii. The collecting of a specimen by Swezey and Williams at Lake Waiau, 13,000 feet, on Mauna Kea, Hawaii, is quite remarkable. Bezzi (1928, p. 119) recorded it from Fiji, and Malloch (1932, p. 215) from the Marquesas Islands.

Family CHIROMYIIDAE

Chiromyia (Scyphella) flava was listed by Giffard (IV: 181, 1919) as a fly common to Hawaii and Samoa. A specimen obtained from Aldrich showed that Hawaiian specimens belong to this species, but not those from Samoa (Bryan, VI: 228, 1926). The species is very rare in Hawaii.

Family CANACIDAE

Cresson (1926, p. 257) described *Canace nudata,* specimens of which were recorded from Oahu, Lisiansky, and Wake Islands by Bryan, (1926, p. 69, and VII: 336, 1931). Cresson (VI: 277, 1926) described *Procanace nigroviridis* for specimens collected on Kauai.

Family EPHYDRIDAE

In 1925 Cresson determined as the cosmopolitan tropical species *Discomyza maculipennis* some strikingly marked flies bred at Bishop Museum from improperly cleaned sea shells (Bryan, VI: 236, 1926). K. O. Moe also bred this species from dead sea shells (Swezey, October 5, 1933 and Bryan November 2, 1933).

Atissa antennalis was described by Aldrich (VII: 395, 1931) for specimens collected in salt pools on Necker Island (Bryan, VII: 336, 1931).

Hecamede albicans, a European immigrant species, was identified by Aldrich from flies swept from salt bush on Kahoolawe (Bryan, VIII: 230, 1933).

Notophila insularis, described by Grimshaw (1901, p. 49) was referred by Malloch to the genus *Paralimna,* which agrees with Jones' (1906) key.

Grimshaw (1901, p. 49 and 1902, p. 85) recorded *Brachydeutera argentata* (Walker). Cresson (VI: 277, 1926) described this Hawaiian fly as a new species, *B. hebes.* Illingworth (III: 270, 1917 and V: 280, 1923) gave notes on its life history and habits. Swezey and Williams (VIII: 188, 1932) noted it as common about puddles on Hawaii. It is well distributed on the main islands. (See Williams, VIII: 29, 1932).

Grimshaw (1901, p. 49 and 1902, p. 85) described as *Scatella hawaiiensis* a little black fly with hyaline spots on grayish wing, found in moist places, such as at the bases of waterfalls. Terry gave the manuscript name, "var. *sexnotata*" of this species to a similar but more opaque form, which is also found in drier, lowland localities. This name was used by Fullaway (III: 21, 1914) for specimens from Laysan island, and by Osborn (III: 90, 112, 1915) for specimens observed at Waikiki, Oahu. Cresson (VI: 275, 1926) described this as *Scatella sexnotata.* Bryan (1926, p. 69 and VIII: 3, 1932) recorded it from brackish pools on islands to the northwest of Kauai. (See Swezey and Williams, VIII: 188, 1932).

Warren (III: 25, 1913) described the life history and habits of a fly which he called "*Ilythea* sp." This was described by Cresson

(VI: 276, 1926) as *Scatella warreni*. In this same paper Cresson (pp. 275-276) described *S. terryi* and *S. bryani*.

Family DIASTATIDAE

Pseudiastata nebulosa Coquillett was introduced from Panama several times between 1924 and 1932, as a predator on pineapple mealybugs (*Pseudococcus brevipes*), but it is not known if this species has become established in Hawaii. (See Reports of the Entomologist, Hawaii Board of Agriculture and Forestry, 1924 to 1930; colored plate (figure 4) opposite page 34 in Report for 1923-1924, 1925).

Family DROSOPHILIDAE

This family of flies, most of which are distinguished by the branched arista on the third segment of the antennae, is the largest family of flies in Hawaii, being represented by four immigrant species which are extremely abundant in the lowlands, and by a number of endemic species, some of which have strikingly pictured wings. To this family belong the little brownish flies, some with pink eyes, which swarm about decaying fruit and garbage pails. There are also species which parasitize spiders' eggs and prey on mealybugs. Five genera are represented by 58 named species, including those described as new below. According to Perkins (1913, p. clxxxix) there remain many more forms to be described, for he estimated that there are fully 250 different species in Hawaii, and (p. xxxvii) stated that "300 would be a moderate estimate" of the existing species in Hawaii. He also gave notes on habits and parasites.

Sturtevant (1921) in his monograph on the North American species, mentioned and briefly discussed many of the native and all of the immigrant species.

Gitonides perspicax, new genus and species, was described by Knab (1914, p. 166). (See Swezey, V: 185, 1923). After seeing the type, Sturtevant (1921, pp. 54, 131) considered *Gitonides* to be a synonym of *Gitona*. (See Bryan, V: 291, 1923). Timberlake (V: 4, 1922) recorded it from Queensland, Manila, Java, and Pusa, India. Fullaway (IV: 241, 1920 and V: 319, 1924) mentioned it as a predator on *Pseudococcus filamentosus* (Cockerell). Swezey (VII: 182, 1928) found it associated with *Trionymus*

(Pseudococcus) insularis (Ehrhorn) on *Panicum torridum*, and (VIII: 12, 1932) bred it from *Cenchrus* grass infested with this mealybug from Molokai. It seems to be a widespread predator on mealybugs.

Titanochaeta ichneumon was discribed by Knab (1914, p. 168) the genus also being described as new. (See Swezey, V: 185, 1923). Swezey (VII: 292, 1929) recorded it as having been reared from spider egg cases on Hawaii and Oahu, since 1908. Another drosophilid, as yet undetermined, was also reported from spider eggs.

The genus *Idiomyia*, described by Grimshaw (1901, p. 50) and briefly discussed by Sturtevant (1921, pp. 55, 116, 131) is distinct from all other known Drosophilidae in having an additional cross-vein connecting the third and fourth longitudinal veins, near the posterior cross-vein. Four species were described by Grimshaw (1901, pp. 51-53), two by Perkins (1910, pp. 699-700), and one is here described as new.

Idiomyia grimshawi new species.

Shiny yellow-brown and dark brown fly; wings brown, with small hyaline spots, much resembling the pattern of *Drosophila picticornis* Grimshaw.

Front light reddish-brown, orbits lighter, and the area between the three amber, bead-like ocellae dark and shining; the usual frontal and vertical bristles, strong, with fine dark hairs on the orbits, external to the three fronto-orbital bristles. Oral margin yellow-brown, somewhat protruding; vibrissae, a row of five or six bristles, the second moderately large, those below diminishing in size. Proboscis and palpi light brown; Antennae light reddish brown, third segment a little darker; arista long plumose, with seven or eight hairs above and three or four below. Back of head below vertex with a broad brown stripe, distinctly lighter on the sides.

Thorax light brown, with a broad central dark brown stripe, which is broader behind, and with an interrupted lateral brown stripe on each side, laterally displaced at the suture; humeral angles yellowish; pleurae light brown with a narrow dark brown stripe extending cephalad from the base of the wing, and two spots between base of wing and middle coxa. Scutellum dark brown, sides lighter. Abdomen shining dark brown. Female ovipositor pointed, pick-shaped, clear yellow-brown.

Legs yellow-brown, parts of one specimen's obscurely darker; rather bare of large bristles except on front femora and apex of tibiae.

Wings marked with brown in such a way as to give one the impression that they are brown with hyaline spots. The spots differ somewhat in size and number, but are as follows: Five or seven in a row in the marginal cell, six or seven in the submarginal cell, two in the first posterior cell before the extra cross-vein and three distad from it, three in discal cell, two or

three in second posterior cell, and two in the distal half of the third posterior cell, the basal half of it being nearly clear. The extra cross-vein is about half its own length basad from the posterior cross-vein.

Length 6 mm.; wing, 5.5 mm.

Type (female), Punaluu, Oahu, 6-11-16 (O. H. Swezey). Type in Bishop Museum. Paratype (female), Mt. Kalena, Waianae Mts., Oahu, April 19, 1931 (F. X. Williams), in Experiment Station H.S.P.A. collection; paratype (female) Mt. Kaala, Oahu, July 4, 1916 (P. H. Timberlake), in Bishop Museum.

Grimshaw (1901, p. 53, pl. III: 5 and 6) described the new genus *Hypenomyia*. Sturtevant (1921, p. 117) places this as "a synonym of Drosophila, in the absence of a satisfactory description." As there are no specimens in Hawaii of the single species which Grimshaw (1901, p. 54) described, we can but leave this record as it stands.

Of *Drosophila*, 40 native species were described by Grimshaw (1901, pp. 57-73; 1902, p. 86), many of them based upon one or two specimens. With such generalized descriptions, few identified specimens at hand for comparison, and the variable nature of so many of the species, these are difficult to positively determine. There are in local collections a number of specimens which cannot certainly be assigned to any species at present known to be present in Hawaii. The writer is here describing only the most distinctive of these as new.

Drosophila immigrans, D. repleta, D. mulleri, and *D. melanogaster* are regarded as the only immigrant species, although it may be possible that some of those described as native may be widespread. These four species were recorded from Hawaii by Sturtevant (1921, pp. 126, 127). Hadden (VI: 386, 1927) reported two of them eaten by the mantis *Paratenodera sinensis*. *D. melanogaster* (under the name *D. ampelophila*) was recorded on overripe fruit in lists of economic insects by Van Dine (1908, p. 44; 1909, p. 32). Illingworth (VII: 256, 1929) regarded *D. repleta* as a minor pest of ripening pineapples, because it helps to spread rot. (See also Bryan, V: 291, 1923). Bezzi (1928) recorded this species from Fiji. All four species are common in the lowlands and lower forests of all the main islands, with *D. immigrans* perhaps the most abundant, although other species may be locally dominant.

Of the native species, Grimshaw's *D. variegata* (1901, p. 57), being preoccupied by *D. variegata* Fallen, was renamed *Drosophila grimshawi* by Oldenberg (1914, p. 23). *D. picticornis* was bred from decayed bananas on Oahu by Terry (I: 126, 1908). *D. molokaiensis* was collected on Molokai by Swezey and Bryan (VII: p. 302, 1929). What may be *D. xanthosoma* was captured at Parker Ranch, Waimea, Hawaii, by Illingworth (V: 277, 1923). *D. crucigera* was bred by Swezey (October 5, 1933) from fruits of *Alectryon macrococcus*, on Oahu, September 17, 1933.

Species of *Drosophila* were reported by Bridwell (IV: 331, 1919) as being stored in *Crabro* nests. Undetermined species appear in various lists. Timberlake (V: 424, 1924) reported a puparium parasitized by *Pachycrepoideus dubius* Ashmead.

Drosophila z-notata new species.

Dark reddish-brown, with lighter lines on the dorsum and sides of the thorax; wings with anterior and apical margins infuscated and a Z-shaped fuscous mark on the disc, from anterior to posterior cross-veins.

Front dark brown, orbits and narrow median line, lighter; face dark brown with a distinct keel, and the lower lateral ridges set with black bristles. Antennae dark brown, apical part of second segment lighter; arista dark brown, long plumose. Proboscis and palpi brown.

Thorax and scutellum dark reddish-brown; dorsum with three obscure lighter lines, which are broader in front, the median line ending at base of scutellum, the two lateral ones continuing onto its antero-lateral angles. Pleurae dark brown with a narrow yellow stripe cephalad from base of wing, and another horizontal yellow line above the bases of the coxae.

Abdomen dark reddish-brown, the posterior margins of the segments very narrowly yellowish.

Legs dark reddish-brown, the extreme tips of the femora lighter and shining. Coxae, especially the middle pair, with long curved black bristles on the anterior distal surface.

Wings dusky, with the marginal cell and second longitudinal vein broadly infuscated; apical part of second, third, and fourth longitudinal veins so broadly infuscated that only two small triangles remain uncolored at the tips of the submarginal and first posterior cells. Disc of wing with a broad Z-shaped fuscous mark, extending along the fourth longitudinal vein from anterior to posterior cross-veins, across the latter, and on the adjacent portions of the third and fifth veins.

Length: 4 mm.; wing, 4.5 mm.

Type and two paratypes from Waiahole, Oahu, March 28, 1915 (O. H. Swezey); two paratypes from Punaluu, Oahu, June 11, 1911, and August 9, 1914 (O. H. Swezey). Type in Bishop Museum.

Drosophila fuscoamoeba new species.

Small, dark brown, with two lateral cinereous stripes on the dorsum; wings with two connected star-shaped fuscous patches, suggesting conventionalized amoeba, with pseudopodia extended.

Front dark brown, orbits broadly light cinereous, with a short, faint, narrow median light line; face yellow-ochraceous. Antennae, proboscis and palpi brown.

Thorax dark brown; dorsum with two lateral cinereous stripes, not reaching the posterior margin; pleurae light at base of wing, on propleura, and an obscure line cephalad from base of wing. Scutellum dark brown, tip lighter; metanotum and halteres brown.

Abdomen entirely dark brown. Legs yellow-brown, posterior femora darker in some specimens; coxae and anterior femora with bristles.

Wings hyaline, with two fuscous blotches: apical patch between 3rd and 4th longitudinal veins, with branches extending to the apex of each vein, to the costal and posterior wing margins, and to the basal patch, which lies between the 2nd and 5th longitudinal veins; this has two arms to the costal margin, one over the tip of the 5th longitudinal vein, and a broad, dividing branch toward the base of the wing. Second longitudinal vein short, entering the costa nearly opposite the posterior cross-vein. Last section of the 4th longitudinal vein 1.3 to 1.5 times the penultimate.

Length: 3 to 3.5 mm.; wing, 3.5 mm.

Type and one paratype, Tantalus, Oahu, September 8, 1907 (Terry); one paratype each: Palolo, Oahu, October 13, 1907 (Terry), Waiahole, Oahu, August 13, 1916 (Swezey), Waiawa, Oahu, August 13, 1916 (Timberlake), Mt. Olympus, Oahu, July 2, 1916 (Timberlake). Type in Bishop Museum.

Drosophila punalua new species.

Ochraceous and brown, with four narrow dark stripes on the dorsum of the lighter thorax; wing with seven fuscous spots along the veins, including an H-shaped spot over the posterior cross-vein.

Front ochraceous, silvery white along the orbits, at bases of fronto-orbital bristles, and about ocellar triangle; face ochraceous with silvery pubescence, without a distinct keel; vertical and ocellar bristles large. Antennae light brown, arista long plumose; proboscis and palpi ochraceous.

Thorax ochraceous, with four narrow, somewhat darker brown stripes on the dorsum, the middle pair extending the entire length from behind head to scutellum, the lateral pair from suture to near posterior margin. Pleurae ochraceous, with obscure darker markings behind the humeri and near the base of the wing in one specimen. Scutellum, metanotum and halteres ochraceous. Sternopleural and two pairs of scutellar bristles, strong.

Abdomen brown, the anterior margins of segments a little darker. Legs ochraceous; the coxae, especially the middle pair, with long black bristles; front femora with two rows of about four black bristles each; middle tibiae with two apical bristles.

Wings hyaline, with rather pale fuscous spots as follows: on the apical part of the 1st longitudinal vein; middle and tip of 2nd longitudinal vein; tips of third and fourth longitudinal veins; anterior cross-vein; and a broad

H-shaped mark over the posterior cross-vein and adjacent portions of fourth and fifth longitudinal veins. Last section of fourth longitudinal vein a little longer than penultimate, slightly wavy.

Length: 4 mm.; wing, 4 mm.

Type and one paratype, Punaluu, Oahu, June 11, 1916, (Swezey); one paratype, unlabeled in Terry collection. Type in Bishop Museum.

Drosophila nigra Grimshaw, variety **iki** new variety.

Shining black, wings tinged with brown, apex darker, and the posterior cross-vein infuscated.

Similar to *D. nigra*, but smaller; the front without a reddish cross-band; the orbits dull, not shining black; proboscis dark, not yellow; antennae dark reddish brown, not black; legs brownish, not yellow, but with femora shining black, as in *D. nigra*; the infuscation at the tip of the wing and over posterior cross-vein, variable in intensity, one specimen being cloudy, the other quite black. Thorax and abdomen uniform shining black.

Length: 4 mm.; wing, 4 mm.

Type, Kilauea, Hawaii, VI, '08, (W. M. Giffard); paratype, Kilauea, Hawaii, dry forest, 4000 feet, 9-1-19 (W. M. Giffard).

Drosophila kauluai new species.

Moderate size, shining light brown; long, pale brownish wings, faintly infuscated on the posterior cross-vein and at the tips of the 2nd and 3rd longitudinal veins.

Front with purplish tinge, orbits and vertical triangle brown; face dark cinereous, with a distinct keel, the lateral depressions darker. Antennae light chocolate brown, third segment rather small, little longer than the second; arista long pubescent. Vibrissae present as a row of six short bristles along the large oral margin, a strong bristle at the lower angle, and a row along the cheek margin, continuing around the posterior orbits.

Thorax yellow-brown, shining; dorsum with numerous small black bristles, and last two dorsocentrals, 2 post-alars, supra-alars, presuteral, 2 humeral, and 2 notopleural bristles strong; pleurae concolorous, with 2 long, outward-pointing sternopleural and 2 hypopleural bristles. Scutellum concolorous, but dull; with 2 strong pairs of bristles, the apical pair crossing; halteres yellow-brown.

Abdomen smoky-brown, posterior margins and lateral edges lighter, thickly covered with black bristles, longest along the margins.

Legs yellow-brown, with numerous short black bristles; front femora with five or six bristles on the outer side; two apical bristles on the tibiae.

Wings long, somewhat cloudy, with iridescent reflections; the posterior cross-vein, and the tips of the 2nd and 3rd, and in some specimens, the 4th longitudinal veins indistinctly infuscated; the last two sections of the 4th longitudinal vein about equal.

Length: 3 to 3.5 mm.; wing, 4 mm.

Type and 12 paratypes, Pacific Heights, Oahu, March 3, 1912 (O. H. Swezey), bred from the fruit of *Sideroxylon* (native name, "kaulu," + "ai," to eat). Type in Bishop Museum.

Family ASTEIIDAE

Two species of Asteia were described by Grimshaw (1901, p. 73). Both are very rare.

Stenomicra angustata ? Coquillett was reported by Williams (VIII: 223, 1933) as sometimes to be seen in sugar cane fields. He described the larvae.

Bryania bipunctata (new genus and species) was described by Aldrich (VII: 395, 1931) for specimens from Nihoa Island. (See Bryan, VII: 336, 1931). The relationship of this new genus was noted by Malloch (1932).

Family CHLOROPIDAE (Oscinidae)

Malloch (1930 and 1932, p. 216) gives *Prohippelates pallidus* (Loew) as the latest name for the species which was recorded from Oahu and islands to the northwest of Kauai as *Hippelates nigricornis* (Bryan, 1926, p. 70, and VII: 235, 1929). It is the same as *Hippelates* sp., recorded from Palmyra Island by Swezey (III: 16, 1914), and is a species widespread in the Pacific.

Siphunculina signata was determined by Aldrich from specimens collected on Oahu and the islands to the northwest of Kauai (Bryan, VII: 335, 1931). Specimens were also collected on Kaula Islet (Bryan, VIII: 245, 1933). Bezzi (1928, p. 153) recorded it from Fiji and as almost cosmopolitan.

Family CARNIDAE

Illingworth (V: 277, 1923) and Bryan (V: 290-1, 1923) recorded two species of small, black, bristly flies, determined by Aldrich as *Rhodesiella elegantula* and *R. tarsalis,* collected by Illingworth at Waimea, Hawaii, in 1922. Both were also found to occur on Oahu, specimens of *R. tarsalis* having been caught as early as 1914 (see Bryan, V: 344, 347, 1924; Wilder, VII: 215, 1929). *R. elegantula* was reported as having been frequently caught in

fruit fly traps (Bryan, VIII: 228, 1933). Bezzi (1928, p. 141) recorded *R. nitidifrons* Becker from Fiji, which may be the same as *R. tarsalis.*

Family MILICHIIDAE

Milichiella lacteipennis, a very abundant shiny black fly with whitish wings, was first recorded (as *Ophthalmomyia)* by Grimshaw (1901, p. 74, pl. III: 21). Knab suggested the change of genus (Bryan, V: 292, 1923). Illingworth (V: 271, 1923) recorded it swarming about tins of hen manure, and (VI: 395, 1927) about droppings of animals in Molokai pineapple fields. It is especially abundant in the lowlands about decaying vegetable matter and resting on green leaves. It was collected on Midway and Pearl and Hermes Reef (Bryan, 1926, p. 70); and was recorded by Bezzi (1928, p. 162) from Fiji and as being widespread.

A related species, *M. circularis,* was described by Aldrich (VII: 397, 1931), the flies having been first found about a "compost heap" at the H.S.P.A. Experiment Station, Honolulu (Swezey, VI: 378, 1926), and later more widespread on Oahu (Illingworth, VII: 29, 1928; 234, 1929; 336, 1931; and Bryan, VII: 335, 1931).

Milichia orientalis is the name given by Aldrich to specimens bred by Illingworth from barley seed (see Bryan V: 290, 1923), and also found on Nihoa, Necker, and Gardner Islands in 1923 (Bryan VII: 336, 1931).

A species of fly bred from hen manure by Illingworth in March, 1916, was determined by Aldrich in 1925 as *Desmometopa m-nigrum,* (see Illingworth, VI: 224, 1926). Additional specimens sent to Aldrich were identified as *D. tarsalis* (Illingworth, VII: 233, 1929). Aldrich stated that he found them quite distinct from European specimens of *D. m-nigrum,* and concluded that he had misidentified the first specimens. Bezzi (1928, pp. 162-3) stated that *D. tarsalis* is distinguished by its entirely black palpi and reddish tarsi; and that *D. m-nigrum* is distinguished by the whitish base of the palpi, which are broadly black at the tips, and by the entirely black tarsi. Either both species occur in Hawaii or else these characters are not reliable, for in series from the same locality specimens occur with black, and black and white, palpi; and the tarsi of none are black, but rather dirty white or light

reddish-brown, the black coloration being due to the thickly set small black bristles. The eyes certainly bear a distinct "black M". Specimens have been bred abundantly from rotting mollusks.

Family OCHTHIPHILIDAE

Leucopis nigricornis has been known in Hawaii since before 1907. Its maggots are predacious on certain aphids and scale insects (see Fullaway, 1909, p. 25), and it is thought to be of European origin, and is fairly common in Hawaiian lowlands (Williams, 1931, p. 307). Timberlake (IV: 330, 1920) recorded *Pachyneuron anthomyiae* Howard as a parasite on it, but (V: 425, 1924) he showed this to be a species quite distinct from that North American *Leucopis* parasite. Later (VI: 309, 1926) he recorded *Pacyneuron eros* Girault from this species.

Family AGROMYZIDAE

Agromyza virens was reported by Illingworth (VII: 359, 1931) as bred from cornflower (*Centaurea*), determination by Aldrich. Swezey (VII: 374, 381, 483, 1931) reported breeding it from stems of *Gnaphalium, Bidens pilosa, Ageratum conyzoides,* and sunflowers. This is the *Agromyza* sp. reported by Swezey (VII: 343, 1931) as bred from *Zinnia* stems. He also bred it from a *Wilkesia* plant which he had brought from Kauai in July, 1932, and growing at his residence in Honolulu (reported January 5, 1933).

Liriomyza pusilla (formerly *Agromyza pusilla*), the "serpentine leafminer," had been known in Hawaii for many years, but not reported until 1917, when Timberlake (III: 404, 1918) recorded *Eucoilidea micromorpha* Perkins as its pupal parasite. He also noted as its parasites (V: 440, 1924) *Chrysocharis parksi* Crawford and *Achrysocharis fullawayi* (Crawford); and (V: 444, 1924) *Diaulinus* sp. as reared from it by Bridwell in 1918. It appears in the list of common names of insects (IV: 609, 1921); was recorded from the summit of Mauna Loa (Bryan VI: 281, 1926); as a pest of cabbages in Kona (Illingworth, VII: 251, 1929); from Molokai (Swezey & Bryan, VII: 302, 1929); near the summit of Mauna Kea (Swezey & Williams, VIII, 191, 1932); and

about the blossoms of *Tribulus* on Nihoa and Johnston Islands (Bryan, 1926, p. 70). The change of genus is on the authority of Bezzi (1928, p. 167) (see Bryan, VII: 403, 1931). This is the species called *A. diminuta* (Walker) by Swezey (II: 226, 1913), which he records as a leafminer of beans, peas, radish, melon, *Bidens, Nasturtium, Sida, Datura, Indigofera, Solanum, Sonchus,* etc.

Ophiomyia lantanae is the latest name for the "lantana seed fly," introduced by Koebele in 1902 from Mexico to help control the spread of *Lantana camara* Linnaeus by attacking the berries. (See Perkins and Swezey, 1924). Swezey (V: 187, 1923) showed that its work was not very efficient; although Illingworth (VII: 253, 1929) considered it an effective check. Froggatt is considered the author as he (1919, pp. 665-8) referred to it as "*Agromyza lantanae,*" with a brief description, not knowing that it was undescribed. A technical description was published by Aldrich (V: 262, 1923). Bridwell (IV: 170-171, 1919) stated that it was parasitized by *Opius lantanae*. Timberlake (V: 361 and 422, 1924) noted it parasitized by *Zatropis tortricidis* Crawford. Bezzi (1928, p. 164) recording it from Fiji, where it was introduced, is the authority for the change of genus (see Bryan, VII: 403, 1931). It was noted by Swezey (September 7, 1933).

Other species of Agromyzidae have been bred (see Swezey, IV: 10, 1919, and Grimshaw, 1901, p. 74).

Family HIPPOBOSCIDAE

The "pigeon fly," *Lynchia maura,* was recorded by Swezey (II: 188, 1912), who received two specimens from a Honolulu pigeon fancier. In December, 1911, Ehrhorn (II: 206, 1913) called attention to the great abundance of this fly about pigeons. In 1916, Knab identified the species for Swezey (III: 272, 1917).

Grimshaw (1901, p. 77) recorded three species of Hippoboscidae, but none by name. Speiser (1902, pp. 87-91) from this same material described *Olfersia acarta* from a short-eared owl, *Ornithoica confluenta* Say var. *peroneura,* from short-eared owl, the *iiwi, Vestiaria coccinea,* and "*Himatione*" = *Chlorodrepanis stejnegeri,* and *Ornithomyia varipes.*

The common large black louse fly on frigate birds, *Olfersia*

spinifera, was recorded by Alfken (1903-4, p. 581), determination by Speiser, and by Bryan (1926, p. 71; VI: 236, 1921), for whom it had been determined by Malloch. This may be the species recorded by W. A. Bryan, (III: 273, 1917). Notes and a figure were given by Ferris and Cole (1922), by whom it was placed in the genus *Pseudolfersia.*

Bryan (IV: 454, 1921) recorded a species which may belong to *Ornithoica* from a pheasant on Kauai.

The "sheep tick," *Melophagus ovinus,* has been twice recorded from the island of Hawaii, (Muir, VII: 4, 1929; Swezey and Williams, VIII: 188, 1932). (See also Ferris and Cole, 1922, pp. 192-3, figs. 8-9).

CHECK LIST OF THE DIPTERA FOUND IN HAWAII

Suborder NEMATOCERA

Superfamily TIPULOIDEA

Family LIMONIIDAE (Limnobiidae)

Subfamily Limoniinae

Limonia (Libnotes) perkinsi (Grimshaw) (*Limnobia perkinsi* Grimshaw)	Oahu, Maui, (probably general).
Limonia (Dicranomyia) bryani Alexander	Hawaii.
" " **foliocuniculator** (Swezey)	Kauai, Oahu, Maui (mines leaves)
" " **grimshawi** (Alexander) (*Dicranomyia apicalis* Grimshaw)	General.*
" " **hawaiiensis** (Grimshaw)	General.
" " **jacobus** (Alexander)	Maui, (may also mine leaves).
" " **kauaiensis** (Grimshaw)	Kauai.
" " **latifrons** (Grimshaw)	Oahu.
" " **nigropolita** (Alexander)	Oahu, Maui.
" " **stygipennis** (Alexander) (*Dicranomyia brunnea* Grimshaw not Doane)	Maui, Hawaii (perhaps gen'l).
" " **swezeyi** (Alexander)	Oahu.
" " **variabilis** (Grimshaw)	Maui.

Subfamily Eriopterinae

Gonomyia (Lipophleps) hawaiiensis Alexander	Oahu.
Trimicra pilipes (Fabricius) (*Trimicra lateralis* Grimshaw)	Probably general, lowlands.
Styringomyia didyma Grimshaw	General, lowlands.

Superfamily CULICOIDEA

Family PSYCHODIDAE

Psychoda alternata Say	Oahu, Molokai, Hawaii (probably general in lowlands).
" **inornata** Grimshaw	Oahu, Hawaii.
" spp.	Oahu.
Telmatoscopus albipunctatus (Williston)	Oahu.

* "General" means found or likely to be found on all the main Hawaiian islands.

Family CULICIDAE

Subfamily Culicinae

Culex quinquefasciatus Say *(Culex fatigans* [Wiedemann])	General ("Night mosquito".)
Aedes albopictus (Skuse) (*Stegomyia scutellaris*) locally.	General ("Forest day mosquito".)
variety **samarensis** Ludlow	Oahu.
Aedes aegypti (Linnaeus) (*Aedes argenteus* (Poiret)) (*Stegomyia fasciata* (Fabricius)).	General, domestic ("Yellow fever mosquito")

Subfamily Megarhininae

Megarhinis inornatus Walker	Oahu, introduced from New Britain, 1929, but probably is not established.

Family CHIRONOMIDAE

Subfamily Chironominae

Chironomus hawaiiensis Grimshaw	General, lowlands.
Tanytarsus lacteiclavus Grimshaw	Kauai, Oahu, Hawaii, (probably general).

Subfamily Orthocladiinae

Orthocladius sp.	Maui.
Orthocladius sp. (subgenus **Psectrocladius**)	Oahu.
Metriocnemus sp.	Oahu, ex water.

Subfamily Clunioninae

Charadromyia torrenticola Terry	Oahu, Maui, Hawaii.
Charadromyia abnormis Terry	Kauai.

Family CERATOPOGONIDAE

Ceratopogon sp.	General.
Ceratopogon sp.	Oahu.
Ceratopogon sp. (subgenus **Prohelea**)	Oahu, Maui, Hawaii.
Apelma brevis Johannsen	Oahu, Lanai (perhaps general in pineapple fields).

Superfamily MYCETOPHILOIDEA

Family MYCETOPHILIDAE

Platyura fuscocostata Grimshaw	Maui, Hawaii.
Platyura hawaiiensis Grimshaw	Oahu, Maui, Hawaii.
Platyura insularis Grimshaw	General (Kauai, Oahu, Molokai, Hawaii).

Family SCIARIDAE

Neosciara molokaiensis (Grimshaw) — General, abundant in lowlands; Midway, Cure.

Neosciara spp.

Superfamily BIBIONOIDEA

Family SCATOPSIDAE

Scatopse spp. ? — Oahu.

Superfamily CECIDOMYIOIDEA

Family CECIDOMYIIDAE

Diplosis (Contarinia) sorghicola (Coquillett) — Oahu, Maui, (ex sorghum and Johnson grass).

Diplosis sp. — Oahu, (ex rust on sorghum leaves).

Contarinia solani (Rubsaamen) — Oahu, (ex tomato buds).

Contarinia maculipennis Felt — Oahu, (ex Hibiscus buds).

Phaenabremia meridionalis (Felt) ("*Itonidid* sp.") — Oahu, Hawaii (ex sugar cane aphis)

Lobodiplosis pseudococci Felt — Oahu, (ex *Pseudococcus brevipes).*

Suborder BRACHYCERA

Division ORTHORRHAPHA

Superfamily TABANOIDEA

Family STRATIOMYIIDAE

Subfamily Actininae

Neoexaireta spinigera (Wiedemann) — General, lowlands and lower forest.

Subfamily Pachygastrinae

Evaza javanensis Meigen — Oahu, Hawaii.

Subfamily Hermetiinae (or Clitellarinae)

Hermetia illucens (Linnaeus) — Hawaii.

Subfamily Geosarginae

Microchrysa hovas Bigot (*Cephalochrysa hovas* (Bigot)) ("*Sargus* sp.") — General, lowlands.

Superfamily ASILOIDEA

Family SCENOPINIDAE

Scenopinus niger Meigen — Oahu.

Scenopinus fenestralis (Linnaeus) — Oahu, Kaula Islet (?)

Scenopinus lucidus Kröber — Oahu, Molokai, Lanai (probably general).

Superfamily EMPIDOIDEA

Family DOLICHOPODIDAE

Subfamily Chrysosomatinae (or Sciapinae)

Sciapus pachygyna Macquart	Lowlands, probably general.
Chrysosoma fraternum Van Duzee	General; Midway, Cure.
(*Psilopus patellifer*, not Thomson)	
Chrysosoma pallidicornis (Grimshaw)	Oahu.
(*Gnamptopsilopus pallidicornis* Grimshaw)	

Subfamily Diaphorinae

Chrysotus spiniger Grimshaw	Maui.
" **saxatilis** Grimshaw	Oahu.
" **pallidipalpus** Van Duzee	Oahu.
" **hawaiiensis** Grimshaw	Hawaii.
" **vulgaris** Van Duzee	Oahu.

Subfamily Campsicneminae

Campsicnemus nigricollis Van Duzee	Kauai.
" **miritibialis** Van Duzee	Oahu.
" **williamsi** Van Duzee	Oahu.
" **gloriosus** Van Duzee	Oahu.
" **sinuatus** Van Duzee	Hawaii.
" **grimshawi** Van Duzee	Hawaii.
" **crinitibia** Van Duzee	Oahu.
" **bellulus** Van Duzee	Oahu.
" **ciliatus** Van Duzee	Oahu.
" **brevipes** Van Duzee	Oahu.
" **distortipes** Grimshaw	Hawaii.
" **strigosus** Van Duzee	Oahu.
" **congregatus** Malloch	Oahu.
" **tibialis** Van Duzee	Hawaii.
" **calcaratus** Grimshaw	Molokai.
" **fimbriatus** Grimshaw	Hawaii.
" **divergens** Van Duzee	Hawaii.
" **inermipes** Malloch	Oahu.
" **rectus** Malloch	Oahu.
" **ornatus** Van Duzee	Oahu?
" **flavicornis** Van Duzee	Oahu.
" **concavus** Van Duzee	Oahu.
" **spinitibia** Van Duzee	Hawaii.
" **octosetosus** Van Duzee	Oahu.
" **obtusus** Van Duzee	Oahu.
" **patellifer** Grimshaw	Oahu.
" **nudifemorata** Van Duzee	Oahu.
Emperoptera mirabilis Grimshaw	Oahu.

Subfamily Rhaphiinae

Syntormon distortitarsis Van Duzee	Oahu.

Subfamily Medeterinae

Medetera hawaiiensis Van Duzee	Hawaii.
" **atrata** Van Duzee	Oahu.
" **cilifemorata** Van Duzee	Oahu.
" **femoralis** Becker	?

Subfamily Sympyconinae

Eurynogaster nitida Van Duzee	Hawaii.
Eurynogaster clavaticauda Van Duzee	Oahu.
Eurynogaster virida Van Duzee	Oahu.

Subfamily Thinophilinae

Sweziella albifacies Van Duzee	Oahu.

Subfamily Hydrophorinae

Hydrophorus pacificus Van Duzee	Oahu, Laysan(?)
Liancalus metallicus Grimshaw	Molokai, Maui, Hawaii (perhaps general).

Subfamily Dolichopodinae

Dolichopus exsul Aldrich	Probably general.
Paraphrosylus sp.	Nihoa, Necker, French Frigates Shoal, Lisiansky, Wake.

Division CYCLORRHAPHA

Series ATHERICERA

Superfamily SYRPHOIDEA

Family PHORIDAE

Conicera atra (Meigen)	Oahu.
Aphiochaeta xanthina Speiser	? Oahu.
Aphiochaeta scalaris (Loew)	General lowlands, and Lisiansky, Pearl and Hermes Reef.
Aphiochaeta setaria Malloch	Maui.
Puliciphora sp.	Oahu.

Family LONCHOPTERIDAE

? Lonchoptera furcata (Fallen)	Molokai, Hawaii.

Family PIPUNCULIDAE

Pipunculus acrothrix Perkins	Hawaii.
" **hawaiiensis** Perkins	Hawaii.
" **holomelas** Perkins	Molokai.
" **juvator** Perkins	Hawaii.
" **molokaiensis** Grimshaw	Molokai.
" **nigrotarsatus** Grimshaw	Hawaii.
" **oahuensis** Perkins	Oahu.
" **pyrophilus** Perkins	Hawaii.
" **rotundipennis** Grimshaw	Hawaii.
" **swezeyi** Perkins	Oahu.
" **terryi** Perkins	Kauai.
" **vulcanus** Perkins	Hawaii.
" spp.	Oahu, Lanai, Hawaii.

Family SYRPHIDAE

Subfamily Volucellinae

Volucella obesa (Fabricius)	General (abundant in lowlands).
Volucella pusilla (Macquart)	Oahu, Molokai (arrived from America, 1930.)

Subfamily Syrphinae

Ischiodon scutellaris (Fabricius) (*Xanthogramma grandicornis* (Macquart)) (*Simosyrphus grandicornis* (Macquart))	General (abundant in lowlands), Johnston, Wake Is.
Allograpta obliqua (Say)	General, lowland.
Toxomerus marginatus (Say)	Kauai, Oahu.

Subfamily Eristalinae

Eristalis tenax (Linnaeus)	General (at higher elevations) (Hawaii, numerous; other islands, scarce or local).
Lathyrophthalmus arvorum (Fabricius) (*Eristalis punctulatus* Macquart)	Oahu, Molokai (may become general).
Lathyrophthalmus aeneus (Scopoli) (*Eristalis aeneus* (Scopoli))	Oahu, Molokai, (may become general) (arrived about 1919)

Subfamily Eumerinae

Eumerus marginatus Grimshaw	General.
Eumerus sp.	Oahu.

Subfamily Xylotinae

Syritta oceanica Macquart	General, lowland.

Series SCHIZOPHORA

Superfamily MUSCOIDEA (or MYODARIA)

Group Calyptratae (or Myodaria superioria)

Family OESTRIDAE

Oestrus ovis Linnaeus	Widespread, but rare. ("Sheep head-maggot.")
Hypoderma lineata (DeVillers)	Kauai, Molokai, Hawaii. ("Heel fly.")

Family TACHINIDAE

Chaetogaedia monticola (Bigot)	General.
Frontina archippivora Williston	General.
Archytas cirphis Curran	General. ("Mexican tachinid armyworm parasite.")
Leucostoma aterrima Williston	Kauai, Oahu, Hawaii (probably general).
Leucostoma atra Townsend	Oahu.
Microceromasia sphenophori (Villeneuve) (*Ceromasia*)	General in sugar cane fields; introduced, 1910. ("Cane-borer parasite.")
Ochromeigenia ormioides Townsend	Introduced, 1926-30, from Formosa. Established?

Family SARCOPHAGIDAE

Sarcophaga barbata Thomson	General, lowland.
" **dux** Thomson	General, lowland.
" **fuscicauda** Böttcher	General, lowland.
" **haemorrhoidalis** Fallen	Oahu, Molokai, Hawaii? (local). ("Dung sarcophaga.")
" **pallinervis** Thomson	General, abundant. ("Cow-dung sarcophaga.")
" **plinthopyga** Wiedemann (*S. robusta* Aldrich)	General.

Family CALLIPHORIDAE

Subfamily Phormiinae

Phormia regina (Meigen)	Hawaii.

Subfamily Chrysomyiinae

Chrysomyia megacephala (Fabricius)	General. ("Sheep blow-fly.")
Chrysomyia rufifacies (Macquart) (*C. albiceps*, locally)	General. ("Australian sheep maggot fly.")

Subfamily Calliphoriinae

Calliphora vomitoria (Linnaeus)	General, especially at higher elevations.
Calliphora latifrons Hough	General (?)
Lucilia sericata (Meigen)	General, Nihoa. ("English bluebottle.")
Lucilia graphita Shannon	Laysan, Midway, Pearl and Hermes, Cure.
Dyscritomyia affinis Grimshaw	Oahu.
" **claripennis** Grimshaw	Hawaii.
" **fulgens** Grimshaw	Lanai.
" **hawaiiensis** Grimshaw	Hawaii.
" **limbipennis** (Thomson)	Oahu, Molokai.
" **terryi** Bryan	Oahu.
Prosthetochaeta robusta Grimshaw	Kauai, Molokai, Lanai.
" **fasciata** Grimshaw	Kauai, Oahu, Lanai.
" **lucilioides** Grimshaw	Hawaii.
" **obscura** Grimshaw	Hawaii.

Subfamily Rhiniinae

Rhinia testacea Desvoidy	Oahu.
Stomorhina pleuralis (Thomson)	General, in lowlands.

(Group Myodaria media)

Family GASTROPHILIDAE

Gastrophilus intestinalis (De Geer) (*G. equi* (Clark))	Hawaii. ("Horse bot-fly.")
Gastrophilus nasalis (Linnaeus)	General, on ranches. ("Chin fly.")

Family MUSCIDAE

Subfamily Stomoxydinae

Lyperosia irritans (Linnaeus) (*Haematobia serrata*, etc.)	General. ("Hornfly.")
Stomoxys calcitrans (Linnaeus)	General. ("Stablefly.")

Subfamily Muscinae

Musca domestica Linnaeus (*Musca vicina*, as determined locally is probably not distinct)	General. ("Housefly.")
Synthesiomyia nudiseta Van der Wulp (*S. brasiliana*, locally)	General (not abundant.)

Family ANTHOMYIIDAE

Subfamily Hydrotaeinae

Hydrotaea houghi Malloch	Hawaii.

Subfamily Phaoniinae

Ophyra nigra (Wiedemann)	General.
" **aenescens** (Wiedemann)	(Probably not in Hawaii.)
" **leucostoma** (Wiedemann)	(Probably not in Hawaii.)
" **chalcogaster** Wiedemann	General, Midway, Cure.

Subfamily Limnophorinae

Limnophora arcuata Stein (or *Eulimnophora*)	General, abundant at lower elevations.

Subfamily Fanniinae

Fannia canicularis (Linnaeus)	Hawaii, Cure. ("Little house-fly.")
Fannia pusio (Wiedemann) (*F. femorata*, locally)	Oahu, Lanai, Hawaii.
Euryomma peregrinum (Meigen)	Oahu.

Subfamily Lispinae

Lispe argentifacies Grimshaw	Kauai?, Lanai.
Lispe cupreigena Grimshaw	Oahu.
Lispa metatarsalis Thomson	Oahu, Hawaii.

Subfamily Coenosiinae

Atherigona excisa (Thomson) var. **trilineata** Stein (*Acritochaeta pulvinata* Grimshaw)	General.
Hoplogaster ? dubia Grimshaw	Hawaii.
Lispocephala atratipes Malloch	Hawaii, Molokai.
" **bispina** Malloch	Loc.?
" **biseta** (Grimshaw)	Hawaii.
" **brevispina** Malloch	Oahu.
" **confluens** Malloch	Maui.
" **crassifemur** Malloch	Oahu.
" **dexioides** (Grimshaw)	Hawaii.
" **dilatata** Malloch	Hawaii.
" **dispar** (Grimshaw)	Molokai.
" **fasciculata** Malloch	Hawaii.
" **flavobasalis** (Grimshaw)	Hawaii.
" **fusca** Malloch	Oahu.
" **fusciseta** Malloch	Oahu.
" **fuscobrunnea** Malloch	Hawaii.
" **fuscofacies** Malloch	Oahu.
" **hirtifemur** Malloch	Kauai.
" **inconstans** Malloch	Oahu.
" **ingens** (Grimshaw)	Molokai, Maui, Hawaii.
" **kauaiensis** (Grimshaw)	Kauai.
" **latimana** (Grimshaw)	Lanai.
" **longipes** (Grimshaw)	Kauai.
" **oahuae** Malloch	Oahu.
" **orbitalis** Malloch	Oahu.
" **pallida** Malloch	Oahu.

Subfamily Coenosiinae (Continued)

Lispocephala pallidibasis Malloch	Oahu, Molokai.
" **paloloae** Malloch	Oahu.
" **pollinosa** Malloch	Maui.
" **plumiseta** Malloch	Hawaii.
" **rudis** (Grimshaw) ?	Maui.
" **rufibasis** Malloch	Molokai, Hawaii.
" **seminigra** (Grimshaw)	Hawaii.
" **seminitida** Malloch	Oahu.
" **striata** (Grimshaw)	Oahu.
" **subvittata** Malloch	Hawaii.
" **triangulifera** (Grimshaw)	Hawaii.
" **valida** (Grimshaw)	Maui.
" **xenina** Malloch	Hawaii.

Subfamily Anthomyiinae

Anthomyia bisetosa Thomson (*A. vicariens,* locally)	General, lowlands. ("Black-banded anthomyiid.")
Hylemyia cilicrura (Rondani) (*Phorbia fusciceps* (Zetterstedt)	General, lowlands. ("Root maggot," or "Corn seed maggot.")

Group Acalyptratae (Myodaria inferiora)

Family SAPROMYZIDAE

Homoneura hawaiiensis Malloch	Kauai, Oahu, Maui, Hawaii, (probably general).
Sapromyza sp.	Molokai?

Family SCIOMYZIDAE

Sciomyza hawaiiensis Grimshaw	Kauai, Oahu, Maui, Hawaii, (probably general).

Family BORBORIDAE

Leptocera ferruginata Stenhammer	General, lowlands.
Limosina venalicia (Osten-Saken)	General, lowlands; Laysan.
Limosina aequalis Grimshaw	Oahu.
Borborus bilineatus Grimshaw	Kahoolawe, Hawaii, (probably general).

Family TETHINIDAE

Tethina insularis Aldrich	Pearl and Hermes Reef.

Family ORTALIDAE (or OTITIDAE)

Subfamily Ulidiinae

Chrysomyza aenea (Fabricius)	General, lowlands.
Euxesta quadrivittata Macquart (*E. annonae* Loew, nec Fabricius)	General, lowlands.
Euxesta semifasciata Malloch	Kauai.
Notogramma stigma (Fabricius)	Oahu.
Acrosticta apicalis (Williston) (*A. pallipes* Grimshaw)	General, lowlands.

Subfamily Platystominae

Scholastes bimaculatus Handel	General, lowlands. ("Coconut fly.")

Family TRYPETIDAE

Subfamily Dacinae

Chaetodacus cucurbitae (Coquillett)	General, lowlands. ("Melon fly.")

Subfamily Ceratitinae

Ceratitis capitata (Wiedemann)	General, lowlands. ("Mediterranean fruitfly.")

Subfamily Tephritinae

Eutreta xanthochaeta Aldrich (*E. sparsa*, locally)	General, lowlands. ("Lantana gallfly," introduced, 1902, to control lantana.)
Phaeogramma vittipennis Grimshaw	Molokai, Maui.
Tephritis crassipes (Thomson)	General, at higher elevations.
" **cratericola** Grimshaw	Maui.
" **dubautiae** Bryan	Oahu.
" **limpidapex** Grimshaw	Maui.
" **swezeyi** Bryan	Oahu.

Family PIOPHILIDAE

Piophila casei (Linnaeus)	Oahu, Hawaii. ("Cheese skipper.")

Family CHIROMYIIDAE

Chiromyia (Scyphella) flava (Linnaeus)	Oahu.

Family CANACIDAE

Canace nudata Cresson	Oahu, Lisiansky, Wake.
Procanace nigroviridis Cresson	Kauai.

Family EPHYDRIDAE

Subfamily Psilopinae

Discomyza maculipennis Cresson	Oahu.
Atissa antennalis Aldrich	Necker Island.

Subfamily Notophilinae

Paralimna insularis (Grimshaw) (*Notophila insularis* Grimshaw)	Oahu.
Hecameda albicans (Meigen)	Oahu, Kahoolawe.

Subfamily Napaeinae

Brachydeutera hebes Cresson (*B. argentata,* locally)	General, in lowland water.

Subfamily Ephydrinae

Scatella hawaiiensis Grimshaw	Oahu, Hawaii; (probably general).
" **sexnotata** Cresson	Oahu, Hawaii, Nihoa, Necker, Laysan, (probably general, frequently near sea).
" **terryi** Cresson	Oahu.
" **warreni** Cresson	Maui.
" **bryani** Cresson	Kauai, Oahu.

Family DIASTATIDAE

Pseudiastata nebulosa Coquillett	Introduced from Panama, 1924-1932; established?

Family DROSOPHILIDAE

Gitona perspicax (Knab) (*Gitonides*)	Oahu, Molokai.
Titanochaeta ichneumon Knab	Oahu, Hawaii.
Drosophila anomalipes Grimshaw	Kauai.
" **carinata** Grimshaw	Hawaii.
" **cognata** Grimshaw	Molokai, Hawaii.
" **conspicua** Grimshaw	Hawaii.
" **crassifemur** Grimshaw	Kauai, Maui.
" **crucigera** Grimshaw	Oahu.
" **exigua** Grimshaw	Hawaii.
" **flaviceps** Grimshaw	Hawaii.
" **fuscoamoeba** Bryan	Oahu.
" **grimshawi** Oldenberg (*D. variegata* Grimshaw, not Fallen)	Molokai, Lanai, Maui.
" **haleakalae** Grimshaw	Maui..
" **hawaiiensis** Grimshaw	Oahu, Hawaii.
" **humeralis** Grimshaw	Kauai, Oahu?
" **immigrans** Sturtevant	General, in lowlands.
" **inaequalis** Grimshaw	Hawaii.
" **infuscata** Grimshaw	Hawaii.
" **kauluai** Bryan	Oahu.
" **lanaiensis** Grimshaw	Lanai, Oahu?
" **longiseta** Grimshaw	Molokai.
" **mauiensis** Grimshaw	Maui.
" **melanogaster** Meigen (*D. ampelophila* Loew)	General, in lowlands. ("Pomace fly.")
" **melanosoma** Grimshaw	Kauai
" **molokaiensis** Grimshaw	Molokai.
" **monticola** Grimshaw	Hawaii.
" **mulleri** Sturtevant	General, in lowlands.

Family DROSOPHILIDAE (Continued)

Drosophila nasalis Grimshaw	Molokai.
" **nigra** Grimshaw	Maui.
" **nigra** var. **iki** Bryan	Hawaii.
" **obscuricornis** Grimshaw	Molokai.
" **obscurifrons** Grimshaw	Molokai.
" **ochracea** Grimshaw	Hawaii.
" **olaae** Grimshaw	Hawaii.
" **parva** Grimshaw	Hawaii.
" **paucipuncta** Grimshaw	Hawaii.
" **perkinsi** Grimshaw	Oahu, Maui, Hawaii.
" **picticornis** Grimshaw	Kauai, Oahu.
" **pilimana** Grimshaw	Kauai, Oahu, Molokai, Hawaii, (probably general).
" **plumosa** Grimshaw	Hawaii.
" **polita** Grimshaw	Lanai, Hawaii?
" **punalua** Bryan	Oahu.
" **pusilla** Grimshaw	Molokai, Maui.
" **repleta** Wollaston	General, in lowlands.
" **setiger** Grimshaw	Oahu, Molokai.
" **sharpi** Grimshaw	Kauai.
" **sordidapex** Grimshaw	Hawaii.
" **undulata** Grimshaw	Hawaii.
" **varifrons** Grimshaw	Oahu.
" **xanthosoma** Grimshaw	Hawaii.
" **z-notata** Bryan	Oahu.
Hypenomyia varipennis Grimshaw	Molokai.
Idiomyia grimshawi Bryan	Oahu.
" **heteroneura** Perkins	Hawaii.
" **oahuensis** Grimshaw	Oahu.
" **obscuripes** Grimshaw	Maui.
" **perkinsi** Grimshaw	Molokai.
" **picta** Grimshaw	Maui.
" **silvestris** Perkins	Hawaii.

Family ASTEIIDAE

Asteia apicalis Grimshaw	Hawaii.
Asteia hawaiiensis Grimshaw	Hawaii.
Stenomicra angustata ? Coquillett	General, cane fields.
Bryania bipunctata Aldrich	Nihoa Island.

Family CHLOROPIDAE (OSCINIDAE)

Prohippelates pallidus (Loew) (*Hippelates nigricornis* Thomson)	Oahu, Kahoolawe, (perhaps general), Lisiansky, Midway, Cure, Wake.
Siphunculina signata Wollaston	Oahu, Kaula, Nihoa, French Frigates Shoal, Lisiansky.

Family CARNIDAE

Rhodesiella elegantula (Becker)	Oahu.
Rhodesiella tarsalis Adams	Oahu, Hawaii.

Family MILICHIIDAE

Subfamily Milichiinae

Milichiella lacteipennis Loew	General; Midway, Pearl and Hermes Reef.
Milichiella circularis Aldrich	Oahu.
Milichia orientalis Malloch	Oahu, Nihoa, Necker, Gardner Island.

Subfamily Madizinae

Desmometopa m-nigrum Zettersted or *D. tarsalis* Loew	Oahu.

Family OCHTHIPHILIDAE

Leucopis nigricornis Egger	Oahu, Kahoolawe (perhaps general).

Family AGROMYZIDAE

Agromyza virens Loew	Oahu
Liriomyza pusilla (Meigen) (*Agromyza diminuta* (Walker))	General ("Serpentine leaf miner.")
Ophiomyia lantanae (Froggatt)	General, lowland. ("Lantana seed fly," introduced from Mexico, 1902.)

Suborder PUPIPARA

Family HIPPOBOSCIDAE

Subfamily Olfersinae

Lynchia maura Bigot	General, about pigeons. ("Pigeon fly.")
Olfersia acarta Speiser	Hawaii, Lanai.
Olfersia spinifera Leach	Kauai, Nihoa, Necker, French Frigates Shoal, Laysan, Lisiansky, Johnston, Wake. ("Frigate bird louse fly.")

Subfamily Ornithomyiinae

Ornithomyia varipes Walker	Molokai.
Ornithoica confluenta Say var. **peroneura** Speiser	Hawaii, Kauai (?).
Ornithoica sp.?	Kauai.

Subfamily Lipopteninae

Melophagus ovinus (Linnaeus)	Hawaii.

REFERENCES

[NOTE:—The following is not a complete bibliography on Hawaiian Diptera. For the sake of brevity, only articles are included to which reference is made in the text. Also, of the notes and papers appearing in the Hawaiian Entomological Society Proceedings, only the most important are listed here, reference being made in the text to others by volume (in Roman numerals), page, and date. Dates in parenthesis, without volume or page, refer to the date of presentation of notes and papers appearing in this number of the "Proceedings"].

Aldrich, J. M. Sarcophaga and allies in North America: Thomas Say Foundation, 301 pp., 16 pls., 1916.
Defines limits of family; keys and notes on species: *S. tuberosa* var. *harpax* = *S. dux*, p. 171; *S. haemorrhoidalis*, p. 189; *S. communis* = *S. pallinervis*, p. 253; *S. robusta* = *S. plinthopyga*, p. 268.

Aldrich, J. M. Two-winged flies of the genera *Dolichopus* and *Hydrophorus* collected in Alaska in 1921, with new species of *Dolichopus* from North America and Hawaii: U. S. National Museum, Proceedings, vol. 61, no. 2446, 18 pp., 1922.
Describes *Dolichopus exsul*, p. 15.

Aldrich, J. M. Descriptions of lantana gallfly and lantana seedfly (Diptera): Hawaiian Entomological Society, Proceedings, vol. V, no. 2, pp. 261-3, September, 1923.
Describes *Eutreta xanthochaeta* n. sp. and *Agromyza lantanae* Froggatt.

Aldrich, J. M. New acalyptrate Diptera from the Pacific and Oriental regions: Hawaiian Entomological Society, Proceedings, vol. VII, no. 3, pp. 395-9, April, 1931.
Describes *Atissa antennalis*, *Tethina insularis*, *Bryania* n. genus, *B. bipunctata*, and *Milichiella circularis*.

Alexander, Charles P. Synonymical and other notes on the Tipulidae (Diptera): Psyche, vol. 18, pp. 192-203, 1911.
Notes that *Dicranomyia brunnea* Grimshaw was preoccupied by *D. brunnea* Doane, p. 194.

Alexander, Charles P. Notes on the crane flies of the Hawaiian islands: Entomological Society of America, Annals, vol. XII: pp. 25-30, 1919. Describes *Dicranomyia stygipennis* (for *D. brunnea* Grimshaw), *D. grimshawi* (for *D. apicalis* Grimshaw), *D. jacobus*, *D. swezeyi*, *Gonomyia (Leiponeura) hawaiiensis*; places *Limnobia perkinsi* Grimshaw in genus *Libnotes*.

Alexander, Charles P. New or little-known crane flies from the Hawaiian islands, (Tipulidae, Diptera): Hawaiian Entomological Society, Proceedings, vol. V, no. 2, pp. 249-251, September, 1923.
Describes *Dicranomyia nigropolita*; gives notes on 8 other species.

Alexander, Charles P. New or little-known Tipulidae, pt. 19: Annals and Magazine of Natural History, ser. 9, vol. 13, pp. 33-49, 1924.
Describes *Limonia (Dicranomyia) bryani*, p. 35.

Alexander, Charles P. Check list of Tipulidae of Oceania: B. P. Bishop Museum, Occasional Papers, vol. IX, no. 21, 12 pp., 1932.
List of Hawaiian species, with revised nomenclature.

Alfken, J. D. Insektenfauna der Hawaiischen und Neuseeländischer Inseln: Zoologische Jahrbücher, vol. XIX, p. 581, 1903-4.
Pseudolfersia spinifera Coq., ex *Fregata aquila*, identified by Speiser.

Anti-Mosquito League. The mosquito, its life history and control in Hawaii. Honolulu, 16 pp., 13 figs., September, 1931.
Notes and figures, 3 species found in Hawaii; life histories; control.

Back, E. A. and Pemberton, C. E. The melon fly in Hawaii: U. S. Department of Agriculture Bulletin no. 491, 1917.
Extensive, illustrated account.

Back, E. A. and Pemberton, C. E. The Mediterranean fruit fly in Hawaii: U. S. Department of Agriculture Bulletin No. 536, 1918.

Back, E. A. and Pemberton, C. E. The Mediterranean fruit fly: U. S. Department of Agriculture Bulletin No. 640, 1918.
Very complete account.

Back, E. A. and Pemberton, C. E. The melon fly: U. S. Department of Agriculture Bulletin No. 643, 1918.
Very complete account.

Bezzi, M. Fruit flies of the genus Dacus *sensu latiore* (Diptera) from the Philippine Islands: Philippine Journal of Science, vol. XV, No. 5, pp. 411-442, 2 pls., November, 1918.
Gives keys to genera and species of *Dacus;* includes *cucurbitae* in *Chaetodacus.*

Bezzi, M. Diptera Brachycera and Athericera of the Fiji Islands: British Museum (Natural History), London, 220 pp., 54 figs., 1928.
Revised nomenclature for many species found in Hawaii.

Bigot, J. M. F. Dipteres nouveaux ou peu connus. 33 partie, XLI. Tachinidae; Société Entomologique France, Annales, ser. 6, vol. VIII, pp. 77-101, 1888.
Describes *Blepharipeza* (= *Chaetogaedia*) *monticola,* p. 91.

Blackburn, Rev. Thomas. Insect-notes from the Sandwich Islands: Entomologists' Monthly Magazine, vol. 13, pp. 227-8, 1877.

Bridwell, J. C. Certain aspects of medical and sanitary entomology in Hawaii: Medical Society of Hawaii, Transactions, 1916-17, pp. 27-32, March, 1918.
(Reviewed in Review of Applied Entomology, Series B, vol. 6, pp. 163-4, 1918.)

Brues, Charles T. Phoridae: Genera Insectorum, 1906.
Table of genera; *Conicera atra* (pl. I, figs. 4, 8); *Aphiochaeta scalaris.*

Brunetti, E. Fauna of British India, Diptera Brachycera I, 1920.
Scenopinus fenestralis reported from Hawaii, p. 312.

Bryan, E. H., Jr. Preliminary notes on the genus Tephritis in Hawaii (Diptera): Hawaiian Entomological Society, Proceedings, vol. IV, No. 3, pp. 475-480, September, 1921.
Describes *Tephritis dubautiae* and *T. swezeyi;* translates description of *T. crassipes* Thomson; key and notes.

Bryan, E. H., Jr., and collaborators. Insects of Hawaii, Johnston Island and Wake Island: B. P. Bishop Museum, Bulletin 31, 94 pp., 9 figs., 1926.
Lists of Diptera, pp. 11-13, 67-71; Shannon describes *Lucilia graphita*, p. 72.

Buxton, P. A. Sarcophagidae: Insects of Samoa, part VI, Fasc. 3, pp. 141-150, 1929.
Records *S. dux* and *S. fuscicauda*.

Cheever, Henry T. The island world of the Pacific: New York, 1851.
Notes on mosquito introduction, p. 105.

Clarke, B. O. Official bulletin of the Bureau of Agriculture: The Hawaiian, vol. 1, p. 6, Honolulu, August 13, 1898.
First reference to melon fly in Hawaii.

Coquillett, D. W. Revision of the Tachinidae of America north of Mexico: U. S. Department of Agriculture, Division of Entomology, Technical Series, Bulletin No. 7, 154 pp., 1897.
Records *Chaetogaedia monticola*, p. 137.

Coquillett, D. W. A new trypetid from Hawaii: Entomological News, vol. 10, pp. 129-130, 1899.
Describes *Dacus cucurbitae.*

Craw, Alexander. Report of the Superintendent of entomology and inspector [1906]. Hawaii Board of Agriculture and Forestry, Report ...., 1906, pp. 139-158, 1907.
Note on importation of *Eucoila impatiens* (Say) (fig.) and other horn fly enemies.

Cresson, E. T., Jr. Descriptions of new species of the Dipterous family Ephydridae from Hawaii: Hawaiian Entomological Society, Proceedings, vol. VI, No. 2, pp. 275-278, July, 1926.
Describes *Scatella terryi*, *S. sexnotata*, *S. warreni*, *S. bryani*, *Brachydeutera hebes*, and *Procanace nigroviridis*.

Cresson, E. T., Jr. Descriptions of new genera and species of Diptera (Ephydridae and Micropezidae): American Entomological Society, Transactions, vol. 52, pp. 249-274, December 16, 1926.
Describes *Canace nudata*, p. 257, from California, and notes it from Hawaii.

Curran, C. H. A new tachinid parasite on armyworms in Mexico: Hawaiian Entomological Society, Proceedings, vol. VI, No. 3, pp. 497-8, October, 1927.
Describes *Archytas cirphis*.

Dove, W. E. Some biological and control studies of *Gastrophilus haemorrhoidalis* and other bots of horses: U. S. Department of Agriculture Bulletin No. 597, 1918.

Edwards, F. W. On the so-called new tipulid subfamily, Ceratocheilinae Wesche: Annals and Magazine of Natural History, ser. 8, vol. VIII, pp. 279-283, 1911.
Idiophlebia pallida Grunberg = *Styringomyia didyma* Grimshaw.

Edwards, F. W. Revision of the tipulid genus *Styringomyia* Lev.: Entomological Society of London, Transactions, 1914, pp. 206-228.
Styringomyia didyma Grimshaw.

Edwards, F. W. Notes on Culicidae, with descriptions of new species: Bulletin of Entomological Research, vol. VII, pp. 201-229, 1916-17.
Notes on *Stegomyia variegata* and *S. albopicta*, p. 209, fig. 5.

Edwards, F. W. British Limnobiidae: some records and corrections: Entomological Society of London, Transactions, 1921, pp. 196-230, 2 plates.
Trimicra lateralis Grimshaw = *T. pilipes* (Fabricius); notes on distribution.

Edwards, F. W. Mosquito notes VI: Bulletin of Entomological Research, vol. XVII, p. 101, 1926.
Aedes albopictus (Skuse).

Ehrhorn, E. M. [Report on Mediterranean fruit fly.] Hawaiian Forester and Agriculturist, vol. VII, p. 336, 1910.
First record in Hawaii.

Ehrhorn, E. M. Mediterranean fruit-fly (*Ceratitis capitata*) Wiedemann: Hawaii Board of Agriculture and Forestry, Circular No. 3, 7 pp., 2 figs., [April 8, 1912].
Life history, hosts, natural enemies, control.

Felt, E. P. A new enemy of the pineapple mealybug and a list of gall midge enemies of mealybugs: New York Entomological Society, Journal, vol. XLI, pp. 87-89, 1933.
Describes *Lobodiplosis pseudococci.*

Felt, E. P. A hibiscus bud midge new to Hawaii: Hawaiian Entomological Society, Proceedings, vol. VIII: No. 2, pp. 247-8, November, 1933.
Describes *Contarinia maculipennis.*

Ferris, G. F. and Cole, M. A. A contribution to the knowledge of the Hippoboscidae (Diptera Pupipara): Parasitology, vol. XIV, No. 2, pp. 178-205, 20 figs., June 15, 1922.
Melophagus ovinus, pp. 192-3, figs. 8-9; *Pseudolfersia spinifera*, pp. 196-8, figs. 13-14.

Froggatt, W. W. The lantana fly (*Agromyza lantanae*): Agricultural Gazette, New South Wales, vol. XXX, pt. 9, pp. 665-8, plate, 1919.
Describes and figures *Agromyza lantanae*, and notes its occurrence in Australia.

Fullaway, David T. Insects of cotton in Hawaii: Hawaii Agricultural Experiment Station, Bulletin 18, 27 pp., 18 figs., 1909.
Lists *Xanthogramma grandicornis* and *Leucopis* sp. among beneficial insects.

Fullaway, D. T. Report of the Entomologist [1912]: Hawaii Agricultural Experiment Station, Annual Report for 1912, pp. 16-34, 1 plate, 1913.
Notes on mosquitoes and their control; brief note on Mediterranean fruit fly.

Fullaway, D. T. Horn fly problem: Hawaiian Forester and Agriculturist, vol. XVII, No. 6, pp. 166-7, June, 1920.

Grimshaw, P. H. Diptera: Fauna Hawaiiensis, vol. III, part 1, pp. 1-77, plates I-III, 1901.

Grimshaw, P. H. Diptera, supplement: Fauna Hawaiiensis, vol. III, part 2, pp. 79-86, 1902.

Grünberg, K. Eine neue Tipuliden-gattung, Idiophlebia nov. gen. von den Karolinen: Zoologischer Anzeiger, vol. XXVI, pp. 524-8, 1903.
Describes *Idiophlebia pallida* [= *Styringomyia didyma* Grimshaw].

Holdaway, F. G. The synonymy and distribution of *Chrysomyia rufifacies* (Macq.) an Australian sheep blowfly: Bulletin of Entomological Research, vol. XXIV, part 4, pp. 549-560, 1933.
C. albiceps = *C. rufifacies.*

Howard, L. O. A dipterous enemy of cucurbits in the Hawaiian islands: U. S. Bureau of Entomology, Bulletin n. s. XXII, pp. 93-4, 1900.
Dacus cucurbitae Coquillett.

Howard, L. O. Diptera collected in Hawaii by H. W. Henshaw: Entomological Society, Washington, Poceedings, vol. IV, part 4, p. 490, 1901.
Lists 19 species, none described.

Hull, F. M. Syrphidae: Insects of Samoa, Part VI, fasc. 4, pp. 191-8, 1929.
Records *Volucella obesa* and *Ischiodon scutellaris.*

Illingworth, J. F. Little brown ant doing good work in Hawaii: Hawaiian Forester and Agriculturist, vol. X, pp. 370-371, 1913.
Pheidole megacephala helps to control house flies.

Illingworth, J. F. Extract from report of August, 1913 . . . on the introduction of the tachinid fly into Fiji: Colonial Sugar Refining Co., Sydney, October 9, 1913.
Ceromasia sphenophori, from Hawaii to Fiji, to control sugar care beetle borer.

Illingworth, J. F. Further notes on the breeding of the tachinid fly, parasite on the cane beetle borer: Journal of Economic Entomology, vol. 7, pp. 390-398, 2 figs., October, 1914.

Illingworth, J. F. Early references to Hawaiian entomology: B. P. Bishop Museum, Bulletin 2, 63 pp., 1923.
Bibliography and notes, prior to about 1900.

Illingworth, J. F. Pineapple insects and some related pests: Association of Hawaiian Pineapple Canners' Experiment Station, Bulletin 9, 64 pp., 44 figs., 1926.
Lists 9 beneficial and injurious Diptera associated with pineapples.

Jarves, James J. History of the Hawaiian or Sandwich Islands: Boston, 1843. Note on mosquitoes, p. 10.

Johannsen, O. A. A new midge injurious to pineapples (Diptera, Ceratopogonidae): Entomological Society Washington, Proceedings, vol. 29, No. 9, pp. 205-8, December, 1927.
Describes *Apelma brevis.*

Jones, Burle J. Catalogue of the Ephydridae . . .: University of California Technical Bulletins, Entomology, vol. I, No. 2, pp. 153-198, October, 1906.
Hawaiian species included in key and list.

Kirkaldy, G. W. Report of . . . Acting Superintendent of Entomology: Hawaii Board of Agriculture and Forestry, 1st report, 1903-4, 1905.
Notes on horn fly and stable fly, p. 133.

Knab, F. The yellow fever mosquito: Science, n. s. XXIII, pp. 270-1, February 16, 1906.
Danger to Hawaii of "*Stegomyia fasciata.*"

Knab, Federick. Drosophila with parasitic larva. (Diptera): Insecutor Inscitiae Menstruus, vol. II, pp. 165-9, 1914.
Gitonides perspicax and *Titanochaeta ichenumon*, new genera and species.

Kotinsky, J. Horn fly and its parasites in Hawaii: Hawaiian Livestock Breeders' Association, Proceedings, pp. 78-80, fig. 9, 1906.

Kotinsky, Jacob. Principal citrus insects in Hawaii: Hawaiian Forester and Agriculturist, vol. 4, pp. 77-80, 1907.
Gives key to eggs, larvae, pupa, and adult of "hover fly" [*Ischiodon scutellaris*].

Ludlow, C. S. Some Philippine mosquitoes: New York Entomological Society, Journal, vol. XI, pp. 137-144, 1903.
Describes *Aedes scutellaris* var. *samarensis*, and records it from Honolulu.

Malloch, J. R. Insects of the dipterous family Phoridae in the United States National Museum: U. S. National Museum Proceedings, vol. 43, pp. 411-529, pls. 35-41, December 14, 1912.
Notes on *Conicera atra*, pp. 413, 437; *Aphiochaeta scalaris*, pp. 413, 467; describes *Aphiochaeta setaria*, p. 514.

Malloch, J. R. Descriptions of new North American Anthomyiidae: American Entomological Society, Transactions, vol. 46, pp. 133-196, 1920.
Describes *Eulimnophora*, genotype, *Limnophora arcuata* Stein, (p. 145).

Malloch, J. R. Exotic Muscaridae (Diptera) XIX: Annals and Magazine of Natural History, ser. 9, vol. 18, pp. 495-522, 1926.
Notes on *Rhinia apicalis*, p. 503, and *R. testacea*, p. 504.

Malloch, J. R. A new species of Sapromyzidae from the Hawaiian islands (Diptera): Hawaiian Entomological Society, Proceedings, vol. VI: No. 3, pp. 383-4, October, 1927.
Describes *Homoneura hawaiiensis*.

Malloch, J. R. The Hawaiian species of the Genus *Lispocephala* Pokorny (Diptera, Anthomyiidae): Hawaiian Entomological Society, Proceedings, vol. VII, No. 1, pp. 67-89, 1928.
Revision and key to group previously known as *Coenosia*; describes 25 new species.

Malloch, J. R. Muscidae: Insects of Samoa, Part VI, fasc. 3, pp. 151-175, 1929. Records 8 species common to Hawaii and Samoa; includes *Musca vicina* with *M. domestica*.

Malloch, J. R. Clusiidae (Heteroneuridae) and Sapromyzidae: Insects of Samoa, Part VI, Fasc. 4, pp. 199-213, 1929.
Records *Homoneura hawaiiensis*, p. 208, and key to related species.

Malloch, J. R. Ortalidae: Insects of Samoa, Part. VI, Fasc. 5, pp. 215-231, 1930
Records *Chrysomyza aenea*, p. 215; *Euxesta semifasciata*, p. 216; *Acrosticta apicalis* [= *A. pallipes* Grimshaw], p. 217; *Scholastes bimaculatus*, p. 223.

Malloch, J. R. Calliphoridae: Insects of Samoa, Part VI, fasc. 5, pp. 233-237, 1930.
Records *Chrysomyia megacephala*, p. 233; *C. rufifacies*, p. 234.

Malloch, J. R. Lonchaeidae, Chloropidae and Piophilidae: Insects of Samoa, Part VI, Fasc. 6, pp. 239-251, 1930.
Records *Prohippelates pallidus* from Samoa, Seychelles, Cuba and Hawaii.

Malloch, John R. Notes on exotic Diptera (2): Stylops, vol. I, part 6, pp. 121-126, June 15, 1932.
Gives key to Hawaiian *Campsicnemus* and describes *C. congregatus*, *C. inermipes*, and *C. rectus*, all from Oahu, pp. 123-4.

Malloch, John R. Two new species of Asteiidae (Diptera) from the Marquesas: Marquesan Insects I, art. 11; B. P. Bishop Museum, Bulletin 98, pp. 115-6, 1932.
Brief note on genus *Bryania*, p. 115.

Malloch, John R. Muscidae of the Marquesas Islands: Marquesan Insects I, art. 21; B. P. Bishop Museum, Bulletin 98, pp. 193-203, 1932.
Records *Ophyra chalcogaster*, p. 196; *Atherigona excisa*, p. 201; *Musca domestica*, p. 203.

Malloch, John R. New species and other records of Otitidae (Ortalidae), Piophilidae, Clusiidae, Chloropidae, and Drosophilidae from the Marquesas: Marquesan Insects I, art. 22; B. P. Bishop Museum, Bulletin 98, pp. 205-223, figs. 48-50, 1932.
Acrosticta apicalis, p. 206; key to ortalid genera, p. 207; *Piophila casei*, p. 215; and *Prohippelates pallidus*, p. 216.

Malo, David (Translated by Dr. N. B. Emerson) Hawaiian antiquities: B. P. Bishop Museum, Special Publication 2, 366, pp., 5 figs., 1 plate, 1903.
Native account of mosquitoes and flies, written about 1832.

Mason, Arthur C. The economic importance of the Mediterranean fruit fly to Hawaiian horticulture: Hawaiian Entomological Society, Proceedings, vol. VIII, No. 1, pp. 163-178, 1932.
Comprehensive review of this pest, arranged by crops; history; bibliography.

Montgomery, James. Journal of voyages and travels by the Rev. Daniel Tyermann and George Bennet, Esq. . . . in the south seas . . . 1821-1829: London, 1931.
Mosquitoes in Hawaii, p. 472.

Muir, F. Report on the sugar cane borer in the Moluccas: Hawaiian Planters' Record, vol. I, No. 2, pp. 40-48, August, 1909.
Preliminary work on introduction of *Ceromasia sphenophori* into Hawaii.

Muir, F. Concluding report on travels in the Malay Archipelago in search of parasites for the cane borer: Hawaiian Planters' Record, vol. I, No. 5, pp. 256-261, November, 1909.
Preliminary work on introduction of *Ceromasia sphenophori* into Hawaii.

Muir, F. and Swezey, O. H. The cane borer beetle in Hawaii and its control by natural enemies: H.S.P.A. Experiment Station, Entomological Bulletin 13, 102 pp., 4 pls., 4 figs., September, 1916.
Ceromasia sphenophori.

Oldenberg, L. Beiträge zur Kenntnis der europaischen Drosophiliden: Archiv für Naturgeschichte, vol. 80, A, 2, pp. 1-42, 1914.
Describes *Drosophila grimshawi*, p. 20.

Osten-Sacken, R. Entomologische Notizen:—II. Einführung von Mücken (Culex) auf den Sandwich-Inseln: Stettin Entomologische Zeitung, vol. 22, pp. 51-52, 1861.
Peale's story of introduction of mosquitoes to Hawaii by ship from Mexico, 1828-1830.

Osten-Sacken, Baron C. R. Facts concerning the importation or nonimportation of Diptera into distant countries: Entomological Society of London, Transactions, 1884, pp. 489-496.
Arrival of Mosquitoes in Hawaii, pp. 494-5.

Parker, Ralph R. Sarcophagidae of New England: males of the genera *Ravinia* and *Boettcheria*: Boston Society Natural History, Proceedings, vol. 35, pp. 1-77, 8 plates, 1914.
Morphological notes on *Sarcophage communis* [= *S. pallinervis*], p. 55.

Parker, R. R. Concerning the subspecies of *Sarcophaga dux* Thomson: Brooklyn Entomological Society Bulletin, vol. XIV, No. 2, pp. 41-46, 13 figs., April, 1919.
Subspecies *dux* and *harpax* noted from Hawaii.

Patton, W. S. and Senior-White, R. The Oriental species of the genus *Musca* Linnaeus: Indian Museum Records, vol. XXVI, part vi, pp. 553-577, pls. xxix-xxxiii, November, 1924.
Key and characters: *Musca domestica* Linn. and *M. vicina* Macquart, pls. xxx and xxxii.

Pemberton, C. E. and Willard, H. F. Contribution to the biology of fruit fly parasites in Hawaii: Journal of Agricultural Research, vol. XV, pp. 419-466, 2 pls., 1918.
Interrelations of parasites of *Ceratatis capitata* and *Chaetodacus cucurbitae*.

Perkins, R. C. L. The leaf hopper of the sugar cane: Hawaii Board of Agriculture and Forestry, Entomology Bulletin No. 1, 38 pp., 1903.
Pipunculus spp. as natural enemies of *Perkinsiella saccharicida;* several Diptera, including *Drosophila* spp. and *Euxesta annonae* breed in injured parts of cane; species of *Sarcophaga, "Eristalis punctulatus,"* and *Volucella obesa* in cane fields.

Perkins, R. C. L. Leaf hoppers and their natural enemies (Part IV. Pipunculidae): H.S.P.A. Experiment Station, Entomology Bulletin I, part 4, pp. 123-157, pls. V-VII, September 9, 1905.
Describes 26 Australian and 5 Hawaiian species; plates, key, and notes.

Perkins, R. C. L. Diptera (Supplement): Fauna Hawaiiensis, vol. II, part 6, pp. 697-700, 1910.

Perkins, R. C. L. Introduction: Fauna Hawaiiensis, vol. I, part 6, pp. xv-ccxxviii, 1913.
Review of Diptera, pp. clxxx-clxxxix.

Perkins, R. C. L. and Swezey, O. H. The introduction into Hawaii of insects that attack lantana: Experiment Station, H.S.P.A., Entomological Bulletin No. 16, 83 pp., 7 figs., 1 plate, September, 1924.
Notes and figures, *Eutreta xanthochaeta* and *Agromyza lantanae*.

Pickering, Charles. The races of men and their geographic distribution: United States Exploring Expedition, vol IX, Philadelphia, 1848.
Introduction of mosquitoes to Hawaii; relation between house flies and man, p. 333.

Ricardo, Gertrude. Stratiomyiidae, Tabanidae, and Asilidae: Insects of Samoa, Part VI, Fasc. 3, pp. 109-122, 1929.
Records *Hermetia illucens*, p. 109; *Microchrysa hovas*, p. 116.

Severin, H. H. P. The life history of the Mediterranean fruit fly (*Ceratitis capitata* Wied.) with a list of fruits attacked in the Hawaiian islands: Journal of Economic Entomology, vol. 6, No. 5, pp. 399-403, 1913.

Severin, H. H. P. and Hartung, William J. Will the Mediterranean fruit fly (*Ceratitis capitata* Wied.) breed in bananas under artificial and field conditions? Journal of Economic Entomology, vol. V, No. 6, pp. 443-451, December, 1912.
Records *Notogramma stigma, Euxesta annonae*, and "*Acritochaeta pulvinata*," pp. 448, 451.

Silvestri, F. Report of an expedition to Africa in search of the natural enemies of fruit flies . . . : Hawaii Board of Agriculture and Forestry, Enomology Bulletin 3, February 11, 1914.

Smith, Jared G. Entomological investigations: Hawaii Agricultural Experiment Station, Report, 1903, pp. 414-418, 1904.
Notes on mosquitoes and other insects.

Speiser, Dr. P. Diptera Pupipara: Fauna Hawaiiensis, vol. III, part. 2, pp. 86-92, 1902.

Sturtevant, A. H. The North American species of Drosophila: Carnegie publication No. 301, 150 pp., 49 figs, 3 plates, 1921.
Lists species recorded from Hawaii; describes *D. immigrans* and *D. mulleri*; see pp. 83-4, 101, 117, 121-140.

Swezey, Otto H. The sugar cane leaf roller (*Omiodes accepta*) with an account of allied species and natural enemies: Experiment Station, H.S. P.A., Entomology Bulletin V, 60 pp., 6 pls., 3 figs., August 20, 1907.
Notes *Frontina archippivora* (p. 47, pl. VI, fig. 4) and *Chaetogaedia monticola* (p. 49) among the natural enemies.

Swezey, O. H. Armyworms and cutworms on sugar cane in the Hawaiian islands: Experiment Station, H.S.P.A. Entomology Bulletin 7, 32 pp., 3 pls., November, 1909.
Notes *Frontina archippivora* (p. 25) and *Chaetogaedia monticola* (p. 25, pl. III, figs. 8-13) with a lengthy note on its curious mode of parasitism.

Swezey, Otto H. A leaf-mining cranefly in Hawaii: Hawaiian Entomological Society, Proceedings, vol. III, No. 2, pp. 87-89, 1 pl., 4 figs., July, 1915.
Describes and figures *Dicranomyia foliocuniculator* and its life-history.

Terry, F. W. A preliminary account of insects of economic importance in the Hawaiian islands. (Diptera): Hawaiian Forester and Agriculturist, vol. III, No. 2, pp. 35-45, 1906.
Notes on several species.

Terry, F. W. On a new genus of Hawaiian Chironomids: Hawaiian Entomological Society, Proceedings, vol. II, No. 5, pp. 291-5, pl. 7, figs. 1-16, July, 1913.
Describes and figures *Charadromyia* n. gen., *C. torrenticola* and *C. abnormis* n. spp.; life-history notes.

Theobald, F. V. A monograph of the Culicidae of the world: British Museum, 5 vols., 1901-1910.
Notes on *Stegomyia scutellaris* (vol. 5, p. 155) and variety *samarensis* Ludlow (vol. 4, p. 179, and vol. 5, p. 156).

Thomson, C. G. Diptera: Voyage de "l'Eugenie," Insects, pp. 443-614, Stockholm, 1868.
(Also known as "Eugenies Resa omkring Jorden"; see pp. 507, 533, 534. 535, 541, 542, 547, 556, 583). Records several species from, and found in, Hawaii.

Van Dine, D. L. Mosquitoes in Hawaii: Hawaii Agricultural Experiment Station, Bulletin No. 6, 30 pp., 12 figs., 1904.
Distribution, abundance, life-histories, breeding places, etc., of three species found in Hawaii; their natural enemies and control.

Van Dine, D. L. Report of the Entomologist: Hawaii Agricultural Experiment Station, Report, 1907, pp. 25-51, 1908.
Contains a "partial list of injurious insects of Hawaii, part 4," pp. 43-48.

Van Dine, D. L. Report of the Entomologist: Hawaii Agricultural Experiment Station, Report, 1908, pp. 17-41, 1909.
Contains "a revised list of the injurious insects of Hawaii," pp. 29-37.

Van Dine, D. L. and Norgaard, V. A. Abstract of a preliminary report on insects affecting live stock in Hawaii: Hawaiian Live Stock Breeders' Association, Proceedings, 5th Annual Meeting, 1907, pp. 19-70, 1908.

Van Duzee, M. C. New Dolichopodidae from the Hawaiian islands: Hawaiian Entomological Society, Proceedings, vol. VIII, No. 2, pp. 307-348, November, 1933.
Revision of Hawaiian species, with keys, figures, and descriptions of 2 new genera and 32 new species; ecological preface by F. X. Williams.

Villeneuve, Dr. J. Description de deux nouveaux Dipteres: Wiener Entomologische Zeitschrift, vol. XXX, p. 81-84, 1911.
Describes *Ceromasia sphenophori.*

Willard, H. F. *Opius fletcheri* as a parasite of the melon fly in Hawaii: Journal of Agricultural Research, vol. XX, No. 6, pp. 423-438, 1920.

Willard, H. F. Some observations in Hawaii on the ecology of the Mediterranean fruit fly, *Ceratitis capitata* Wiedmann, and its parasites: Hawaiian Entomological Society, Proceedings, vol. VI, No. 3, pp. 505-515, October, 1927.
History, ecology, hosts, and status of *Ceratitis capitata* in Hawaii, and the interrelations of its parasites.

Williams, Francis X. Handbook of the insects and other invertebrates of Hawaiian sugar cane fields: Hawaiian Sugar Planters' Association, Honolulu, 400 pp., numerous plates and figures, 1931.
Brief synopses of principal families of Diptera found in Hawaii, with mention of many lowland and commoner native species.

Australian Butterflies—A Review

BY E. H. BRYAN, JR.

(Presented at the meeting of April 6, 1933)

Dr. G. A. Waterhouse, and the publishers, Angus and Robertson, Sydney, are to be congratulated upon the production of another splendid work on Australian Natural History. This volume is a guide to the butterflies of Australia, entitled, "What butterfly is that?", 291 pp., 34 plates, 4 figures, 1932.

The data appear to be accurate and authoritative; no work on Australian butterflies by Dr. Waterhouse could be otherwise. The arrangement is concise, comprehensive and attractive. And best of all, the volume is distinctly popular, even to the price, which is 12/6. How such a book, with artistic plates showing each of the 339 species of Australian butterflies and skippers in natural colors, can be sold for such a low price is something American publishers should investigate and try to emulate. It seems to be both possible and profitable in Australia, for a companion volume, "What bird is that?", by Neville W. Cayley, which illustrates all of Australia's birds in natural colors, also sells for 12 shillings and 6 pence and is now in its third edition.

This popular work has been in the author's mind for many years. In 1914, with Geo. Lyell, he produced a monographic study, "The butterflies of Australia," also published with colored plates by Angus and Robertson. The present volume, as far as possible, avoids technical terms. It seeks to enable anyone to identify readily any butterfly likely to be seen in the settled parts of Australia. There is a comprehensive introduction, giving the position of butterflies in nature, their life histories, and such details of morphology and taxonomy as are necessary for the identification of species. The general characteristics of egg, larva, pupa, and adult are given for each of the eight groups of butterflies and the skippers. The subjects of variation and distribution are interestingly discussed. And there is a final chapter on collecting and mounting butterflies.

For each of the 339 species the following is given: the popular and scientific names, the distribution, a non-technical description, notes on life histories and habits, and colored illustrations, including one of each sex, when these are different. On these plates the upper surface of the wings are shown on the left side and the lower on the right, thus outlining the whole butterfly, so that one's sense of form is not disturbed. Plates of larvae in black and white are also shown.

Persons interested in Australia's insect life are very fortunate in having such books as this one and R. J. Tillyard's "Insects of Australia and New Zealand," published by Angus and Robertson in 1926. There is great need in Hawaii for just such books, both technical and popular, bringing our knowledge of Hawaii's interesting insect life down to date, and making it available to the student and amateur.

Gulliver in the Bush—A Review

BY E. H. BRYAN, JR.

(Presented at the meeting of August 3, 1933)

Gulliver in the Bush. Wanderings of an Australian entomologist, by H. J. Carter. Angus & Robertson, Sydney, 234 pages, 9 plates, 1933.

Entomology has of recent years gradually risen in the public esteem from being considered an amusing and freakish hobby to being admitted into the category of useful sciences. In America, and especially here in Hawaii, this has largely come about through the activities of professional entomologists, connected with scientific institutions. In the British Empire, although considerable research has been done by professional entomologists, perhaps even more has been done by amateur collectors and students of insect life.

One of the outstanding amateur entomologists in Australia is H. J. Carter. A schoolmaster by profession, he has devoted his spare time for more than a third of a century to the collecting and study of Australian insects, especially beetles. He has become an authority on the beetles of Australia. In addition, he is an all-around naturalist and lover of the out-of-doors.

Mr. Carter has produced a little book of reminiscences of his collecting experiences in many parts of Australia. Its chapters are packed with interesting information about the Australian countryside: its geology, trees, plants, and insect life. His style is delightfully informal and, in places, droll. In relating his experiences he gives the reader little intimate pictures of other distinguished Australian entomologists.

The title, "Gulliver in the Bush," is somewhat misleading. There is no Lilliputian pretense. Rather, a straightforward, intimate description of Australian out-of-doors for the lover of nature. The beetle enthusiast will find scientific names and bibliographic references, unobtrusively inserted. The travel-minded will find de-

lightful descriptions of regions and places of interest. To those who have visited Australia the little book will bring back happy memories of places and persons.

There are twenty illustrations, showing scenes, insects, and entomologists, all excellently reproduced from photographs, in nine plates. The price (six shillings) is very reasonable for a book of such quality.

Description d'un Elateride nouveau

BY E. FLEUTIAUX, NOGENT-SUR-MARNE, FRANCE

(Presented by Mr. Van Zwaluwenburg at the meeting of May 4, 1933)

Symphostethus pacificus nov. sp.

15 m/m.—Allongé, subparallèle. Tête noire, aplatie en avant, finement et densément ponctuée; pubescence rousse en avant, noire en arrière. Antennes noires, ne dépassant pas les angles postérieurs du pronotum; 2e article petit, suivants beaucoup plus longs, subégaux, comprimés, serriformes. Pronotum aussi long que large à la base; rétréci en avant, finement limité latéralement, déprimé sur le dos, caréné au milieu à la base, finement et densément ponctué; rouge avec une tache noire au milieu en avant, une plus petite sur les bords externes au tiers antérieur et une autre à la base, en avant de l'écusson; pubescence rousse, noire sur les taches; angles postérieurs aigus, non divergents, bicarénés. Elytres de la largeur du pronotum, subparallèles, rétrécies dans le dernier quart, tronqués au sommet, peu convexes, ponctués-striés; interstries plans, très finement en densèment ponctués, 3e costiforme à la base; noirs; pubescence noire. Propectus jaune, ponctuation fine, peu serrée; sutures obscures. Epipleures des élytres parallèles, noirs, jaunes en avant. Métasternum proéminent en avant, noir, jaune au milieu; bords de la fossette perpendiculaires et tranchants; ponctuation fine et serrée. Episternes métathoraciques rétrécis en arrière. Hanches postérieures légèrement et graduellement élargies en dedans. Abdomen noir, finement et densèment ponctué. Fémurs et moitié antérieure des tibias jaunes, reste des pattes noir.

Iles Salomon: Bougainville, un exemplaire, ma collection; Guadalcanar, un exemplaire, collection Giffard, B. P. Bishop Museum de Honolulu.

Différent de *S. collaris* Schwarz par sa forme moins étroite, moins parallèle; tête noire; pronotum plus grand, moins inégal, légèrement arrondi sur les côtés et régulièrement rétréci en avant, maculé au milieu du bord antérieur et sur les bords latéraux, caréné en arrière et obscurci devant l'écusson, angles postérieurs non divergents; élytres moins longs, moins parallèles, tronqués au sommet au sommet; fémurs et moitié antérieure des tibias jaunes.

Quatre Elaterides nouveaux

BY E. FLEUTIAUX, NOGENT-SUR-MARNE, FRANCE

(Presented by Mr. Van Zwaluwenburg at the meeting of September 7, 1933)

Alaus ferrugineus n. sp.

Amboine (F. Muir). Un exemplaire, ma collection.

15 m/m.—Etroit, subparallèle; rouge ferrugineux avec deux petites taches noires rapprochées, au delà de la moitié, près du bord externe et quelques autres le long du bord, avant l'extrémité; pubescence jaune. Tête aplatie en avant; ponctuation grosse, irrégulière, espacée, mélangée à des points fins et légers plus serrés, peu apparents. Antennes ferrugineuses. Pronotum plus long que large, sinué sur les côtés, non rétréci en avant, mais arrondi aux angles antérieurs, peu convexe, cans côte médiane, avec un faible renflement en arrière au milieu, déprimé à la base, ponctué comme la tête; angles postérieurs divergents, carénés. Ecusson oblong, incliné. Elytres parallèles, rétrécis au delà moitié, séparément èchancrés au sommet, ponctués-striés; interstries plans, finement et éparsément pointillés. Dessous de même couleur. Fémurs obscurs; tibias et tarses ferrugineux.

Se place dans le voisinage de *A. elaps* Candèze; plus étroit, plus parallèle; téguments ferrugineux; pubescence uniforme, moins apparente; pronotum plus long.

Anchastus zwaluwenburgi n. sp.

Célèbes, Macassar, mai (R. H. van Zwaluwenburg). Un exemplaire, ma collection.

7 m/m.—Ovale, peu convexe; brun assez brillant, plus clair sur les bords du pronotum et des élytres; pubescence jaune. Tête peu convexe, densément ponctuée. Antennes brun clair, atteignant la moitié du corps, comprimées à partir du 4e article; 2e court, globuleux; 3e de même forme, un peu plus long; suivants beaucoup plus longs et élargis vers le bout. Pronotum court, arqué sur les côtés, rétréci en avant, peu convexe, peu densément ponctué, très finement sur les dos, plus distinctement sur les flancs; angles postérieurs longs, robustes, incurvés, aigus et carénés loin du bord externe. Elytres atténués, ponctués-striés; interstries très finement pointillés. Dessous et pattes pâles, les fémurs plus clairs.

Voisin de *A. nitidus* Candèze; pubescence jaune; pronotum plus court, plus arrondi sur les côtés, moins rétréci en avant; angles postérieurs incurvés.

Arhaphes terminatus n. sp.

Bornéo: Telok Ayer (F. Muir). Un exemplaire, ma collection.

4 m/m.—Oblong, subcylindrique; noir à peine brillant, tête, angles postérieurs du pronotum et extrémité des élytres testacé pâle; pubescence grise légère. Tête aplatie, légèrement rugueuse. Antennes filiformes, obscures, testacé pâle à la base. Pronotum plus long que large, légèrement rétréci en avant, très convexe, nettement limité latéralement, brusquement déclive à la base, granuleusement ponctué; angles postérieurs aigus, non divergents, carénés; carène coudée en dedans. Ecusson enfoncé. Elytres courts, subdilatés en arrière, largement arrondis à l'extrémité, très convexes, ponctués-striés; interstries convexes. Dessous noir, moitié antérieure du prosternum, angles externes des propleures et derniers arceaux de l'abdomen testacés. Propleures fortement ponctués, moins densément en arrière. Prosternum et arrière-corps moins fortement ponctués. Pattes testacé pâle.

Jolie espèce voisine de *A. candezei* Fleutiaux; plus robuste. Tête, angles postérieurs du pronotum et extrémité des élytres testacés. Pronotum plus long, graduellement rétréci en avant. Elytres courts, dilatés en arrière.

Zorochrus oblongus n. sp.

Inde: Pusa (T. B. Fletcher). Ma collection, et H.S.P.A. Experiment Station de Honolulu.

2 m/m. ¾.—Oblong, peu convexe; noir presque opaque; pubescence jaune. Tête peu convexe; ponctuation espacée. Antennes noires, 2e et 3e articles testacés. Pronotum à peu près aussi long que large, un peu dilaté en avant, convexe; ponctuation espacée sur un fond légèrement alutacé; angles postérieurs non divergents, longuement et très finement carénés. Elytres courts, subparallèles, arrondis au sommet, très légèrement striés; interstries plans, très finement chagrinés. Dessous de même couleur. Pattes testacées.

Plus petit que *Z. indicus* Motschulsky; pronotum relativement plus long, subdilaté en avant; carène des angles postérieures longue, légère, rapprochée du bord latéral; élytres subparallèles, largement arrondis à l'extrémité, plus légèrement striés.

Elaterides nouveaux des Iles Philippines

BY E. FLEUTIAUX, NOGENT-SUR-MARNE, FRANCE

(Presented by Mr. Van Zwaluwenburg at the meeting of September 7, 1933)

Agrypnus lopezi n. sp.

Mindanao: Bukidnon, Diklom. 2000 pieds, mars (F. C. Hadden). Ma collection, et H.S.P.A. Experiment Station de Honolulu.

33 m/m.—Allongé; brun; pubescence rousse. Tête creusée au milieu, densément ponctuée. Antennes brun clair, comprimées et serriformes. Pronotum un peu plus long que large, sinué en avant et latéralement, déprimé de chaque côté, fortement et densément ponctué; angles postérieurs divergents, longuement carénés. Elytres atténués, entiers au sommet, très finement chagrinés, striés-ponctués. Dessous de même couleur. Pattes brun clair.

Ressemble à *A. luridus* Fabricius; moins convexe; pronotum non rétréci en avant, très largement déprimé de chaque côté de la ligne médiane, comme chez *A. ereptus* Candèze, duquel il diffère par la ponctuation du pronotum plus forte et les angles postérieurs longuement carénés.

Adelocera (ex Lacon) lopezi n. sp.

Negros occ.: La Carlota, juin (Al. Lopez). Ma collection et H.S.P.A. Experiment Station de Honolulu.

15 m/m.—Oblong, peu convexe; brun; pubescence blanchâtre courte, très rare. Tête peu convexe, légèrement biimpressionnée au milieu, fortement et densément ponctuée. Antennes brunes, courtes, serriformes à partir du 4e article, 2e et 3e subglobuleux, égaux. Pronotum à peine plus long que large, arqué sur les côtés, rétréci en avant et en arrière, peu convexe; bord antérieur échancré en cercle; surface traversée par une crête longue, au milieu et en arrière de la moitié; ponctuation forte et assez dense, avec des points plus petits dans les intervalles; angles antérieurs prolongés en avant et arrondis; postérieurs peu divergents et tronqués, très longuement carénés près du bord externe jusque près des angles antérieurs. Elytres légèrement arqués sur les côtés, rétrécis dans le dernier tiers, conjointement arrondis au sommet; faiblement ponctués-striés; interstries plans, finement et densément pointillés. Dessous de même couleur, densément ponctué. Pattes brunes.

Voisin de *A. cervina* Erichson; plus allongé; pubescence courte, rare, ne formant pas de taches; pronotum plus long à peu près également détréci en avant et en arrière, avec une carène transversale au delà de la moitié et de petits points serrés dans l'interv-

alle de la grosse ponctuation; élytres rétrécis seulement dans le dernier tiers.

Lacon (Adelocera) philippinus n. sp.

Mindanao: Zamboanga, Kabasalan, avril (H. C. Muzzall). Un exemplaire, ma collection.

11 m/m.—Allongé; brun clair; squamules jaunes. Tête impressionnée en avant, fortement ponctuée. Antennes brunes, courtes, très faiblement comprimées, a peine dentées. Pronotum aussi long que large, arrondi latéralement, rétréci en avant et en arrière, convexe, brusquement déclive dans la partie postérieure, impressionné au milieu à la base; ponctuation grosse et serrée; angles postérieurs petits, aigus, divergents. Elytres arrondis sur les côtés et atténués, non striés, couverts d'une ponctuation assez grosse disposée en lignes très rapprochées. Dessous de même couleur, ponctuation dense, plus grosse en avant. Hanches postérieures élargies en dedans, très étroites en dehors. Pattes brunes.

Taille beaucoup moindre que *L. luzonicus* Candèze; de couleur moins foncée; pronotum non sillonné au milieu, simplement impressionné au milieu à la base.

Alaus farinulentus n. sp.

Luzon, Mt. Province: St. Thomas—Mt. Data; 5000 pieds, mai (F. C. Hadden). Ma collection, et H.S.P.A. Experiment Station de Honolulu.

25 m/m.—Large; noir; vestiture blanche serrée, pronotum dénudé sur la ligne médiane, élytres avec des taches noires au delà de la moitié; une petite sur le bord externe, une plus grande au milieu et quelques petites hachures vers le bout. Tête creusée; ponctuation peu serrée. Antennes noires, courtes, serriformes. Pronotum penché, plus long que large, graduellement rétréci en avant; bord antérieur sinué, en bourrelet sur le milieu; surface déprimée latéralement; ponctuation espacée, presque nulle au milieu; angles postérieurs divergents carénés. Ecusson oblong, incliné en avant. Elytres légèrement arrondis, atténués en arrière carrément tronqués au sommet; striés; interstries convexes, le 3e costiforme à la base; calus huméral saillant. Dessous également noir, tapissé de poils blancs, dénudé sur le milieu; ponctuation légère. Pattes noires, couvertes des mêmes poils blancs.

Voisin de *A. appendiculatus* Herbst; de forme plus large; pronotum rétréci en avant.

Heteroderes pallidus n. sp.

Luzon: Los Baños, octobre-novembre (F. Muir). Un exemplaire, ma collection.

6 m/m. ½.—Oblong, large, déprimé; jaune pâle; pubescence de même couleur. Tête convexe, densément ponctuée. Antennes jaune pâle, n'atteignant pas tout à fait l'extrémité des angles postérieurs du pronotum, subfiliformes; 3e article légèrement plus long que le 2e et de même forme; suivants plus longs, très faiblement épaissis au sommet. Pronotum à peu près aussi long que large, peu convexe, brusquement déclive près de la base; ponctuation grosse sur un fond alutacé; angles postérieurs relevés, non divergents, unicarénés. Elytres courts, arrondis sur les côtés, rétrécis en arrière, à peine convexes, striés-ponctués. Dessous de même couleur. Hanches postérieures brusquement rétrécies en dehors. Pattes jaune pâle.

Voisin de *H. oblitus* Candèze; beaucoup plus court, entièrement jaune.

Melanoxanthus longicollis n. sp.

Mindanao: Bukidnon, Diklom, 2000 pieds, mars (F. C. Hadden). Un exemplaire, ma collection.

7 m/m ½.—Allongé, convexe; noir brillant, élytres jaune pâle sauf à l'extrémité; pubescence courte, de la couleur du fond. Tête convexe, légèrement carénée au milieu, très densément ponctuée. Antennes noires, comprimées et élargies vers le bout, ne dépassant pas les angles postérieurs du pronotum. Pronotum notablement plus long que large, élargi en avant, sinué latéralement, très convexe, déprimé à la base, sillonné au milieu en arrière; ponctuation fine, peu serrée; angles postérieurs à peine divergents, carénés. Ecusson triangulaire, plan, densément ponctué. Elytres atténués, tronqués au sommet, finement ponctués, indistinctement striés. Dessous noir, très finement ponctué. Fémurs noirs; tibias et tarses jaune pâle.

Se rapproche de *M. subcylindricus* Candèze; forme plus longue, plus atténuée en arrière; aspect plus lisse, plus brillant; élytres presque entièrement jaunes.

Melanoxanthus basalis n. sp.

Luzon: Laguna, Mt. Makiling, mai (F. C. Hadden). Un exemplaire ma collection.

6 m/m.—Allongé; noir peu brillant, tache rousse aux épaules; pubescence de la couleur du fond. Tête convexe, densément ponctuée. Antennes noires, 1er, 2e et 3e articles testacés. Pronotum plus long que large, parallèle en arrière, arrondi en avant, convexe; ponctuation dense, fine en avant, grosse en arrière; angles postérieurs non divergents, carénés. Elytres de la largeur du pronotum, graduellement atténués, convexes, fortement ponctués-striés, très légèrement vers le bout; grande tache rousse à la base, plus étendue à l'épaule; interstries faiblement ponctués. Dessous entièrement noir. Pattes testacées.

Voisin de *M. dorsatus* Candèze; plus atténué; ponctuation plus grosse; tache des élytres humérale et plus rousse.

Melanoxanthus bilineatus n. sp.

Luzon: Laguna, Mt. Makiling, mars, juin (F. C. Hadden). Ma collection, et H.S.P.A. Experiment Station de Honolulu.

5 m/m.—Allongé, subparallèle, peu convexe; jaune, avec le tète obscure en arrière, deux bandes longitudinales noirâtres sur le milieu du pronotum et trois taches dans le sens de la longueur sur chaque élytre; celle de la moitié plus grande; pubescence jaune légère. Tête peu convexe, densément ponctuée, bord antérieur arrondi et rebordé. Antennes jaune pâle, subfiliformes, atteignant le sommet des angles postérieurs du pronotum. Pronotum plus long que large, graduellement et faiblement rétréci en avant, peu convexe, densément ponctué; angles postérieurs longs, aigus, non divergents, fortement et longuement carénés. Elytres très légèrement rétrécis en arrière, conjointement arrondis au sommet; striés-ponctués; stries effacées à la base. Dessous noirâtre; prosternum jaune. Pattes jaune pâle.

Forme allongée de *M. festucalis* Candèze; couleur jaune dominante. Pronotum avec deux bandes noirâtres; élytres avec trois taches mal définies s'échelonnant du premier quart à l'extrémité, stries moins marquées.

Melanoxanthus acutifrons n. sp.

Luzon: Laguna, Mt. Makiling, mars (G. C. Ladrera). Un exemplaire, ma collection.

4 m/m ½.—Allongé, subparallèle, peu convexe; jaune avec une étroite bande noire sur le milieu du pronotum et une autre sur la suture des élytres, abrégée près du sommet; pubescence jaune légère. Tête peu convexe, densément ponctuée; bord antérieur en pointe obtuse. Antennes jaunes, subfiliformes, dépassant les angles postérieurs du pronotum. Pronotum beaucoup plus long que large, parallèle, densément ponctué; angles postérieurs aigus, non divergents, brièvement et finement carénés. Elytres très faiblement rétrécis en arrière, conjointement arrondis à l'extrémité, striés-ponctués. Dessous jaune. Pattes plus claires.

Très voisin de *M. bilineatus*; simplement orné d'une étroite bande noire au milieu dans la longueur du pronotum et jusque près du sommet de la suture des élytres. Pronotum long, parallèle; angles postérieurs courts, plus finement carénés.

Melanoxanthus parvulus n. sp.

Luzon: Laguna, Mt. Makiling, avril (F. C. Hadden). Plusieurs exemplaires.

2 m/m ½ à 2 m/m ¾.—Allongé; jaune mat, tête et pronotum, sauf sur les bords, noirâtres; pubescence jaune. Tête convexe, densément ponctuée. Antennes testacé pâle, obscures vers le bout, légèrement épaissies au sommet. Pronotum à peu près aussi long que large, faiblement rétréci en avant, con-

vexe, densément ponctué; angles postérieures à peine divergents, carénés. Elytres convexes, striés-ponctués; interstries pointillés. Dessous noirâtre. Femurs obscurs; tibias et tarses testacé pâle.

Ressemble à *M. fusus* Candèze; beaucoup plus petit, plus finement ponctuée.

Megapenthes ornaticollis n. sp.

Mindanao: Bukidnon, Diklom, 3000 pieds (F. C. Hadden). Un exemplaire, ma collection.

14 m/m ½.—Allongé; pubescence jaune. Tête jaune, noire en arrière, convexe, densément ponctuée; bord arrondi. Antennes filiformes testacées, n'atteignant pas les angles postérieurs du pronotum; 3e article plus long que le 2e. Pronotum noir avec le milieu brun et de chaque côté, une bande longitudinale jaune en dedans du bord externe; plus long que large, parallèle, arrondi en avant, convexe, brusquement déprimé à la base et impressionné au milieu en arrière; ponctuation serrée, un peu plus grosse sur les flancs; angles postérieurs longs, aigus, peu divergents, fortement bicarénés. Elytres jaunâtres, largement bordés de noir sur les côtés, convexes, échancrés au sommet, légèrement striés-ponctués; interstries plans, finement et densément ponctués. Propleures jaunes avec une bande longitudinale au milieu et l'extrême bord externe noirs. Prosternum noir. Arrière-corps obscur. Pattes testacées.

Voisin de *M. junceus* Candèze: prosternum orné de bandes: élytres bordés latéralement.

Megapenthes haddeni n. sp.

Luzon: Laguna, Mt. Makiling, avril (F. C. Hadden). Un exemplaire, ma collection.

13 m/m.—Allongé; jaune, avec la tête, une large bande sur le milieu du pronotum et l'extrémité des élytres noirs; pubescence de la couleur du fond. Tête convexe, densément ponctuée. Antennes atteignant les angles postérieurs du pronotum, noires, serriformes à partir du 4e article; 3e deux fois plus long que le 2e, élargi au sommet, mais beaucoup moins que les suivants. Pronotum à peu près aussi large que long, rétréci en avant, peu convexe, brusquement déclive en arrière, brièvement impressionné au milieu en face de l'écusson. Ecusson creusé, ponctué densément en avant, moins en arrière. Elytres graduellement rétrécis, conjointement subtronqués au sommet, profondément striés-ponctués; interstries convexes, finement et densément ponctués. Propectus jaune. Prosternum bordé de noir en arrière. Arrière-corps noir, légèrement ponctué. Hanches postérieures faiblement élargies en dedans; bord inférieur sinué. Pattes noires, tarses moins foncés.

Très jolie espèce, distincte de toutes les autres par sa coloration spéciale.

Megapenthes magnus n. sp.

N. Luzon: Mt. Province, Camp 82, 6000 pieds, mai (F. C. Hadden). Un exemplaire, ma collection.

18 m/m.—Allongé; épais; brun noirâtre; pubescence obscure, clairsemée. Tête convexe, grossièrement et rugueusement ponctuée; bord antérieur arrondi et rebordé. Antennes brunes, ne dépassant pas les angles postérieurs du pronotum; 2e et 3e articles étroits, 3e un peu plus long que le 2e; suivants plus grands et plus larges au sommet. Pronotum sensiblement aussi large que long, arrondi sur les côtés, légèrement rétréci en avant, convexe, déclive en arrière, impressionné à la base, sillonné au milieu; ponctuation grosse et serrée en avant, moins forte en arrière; angles postérieurs aigus, faiblement divergents, bicarénés, carène externe très près du bord latéral. Ecusson quadriforme, ponctué. Elytres convexes, subdilatés en arrière, arrondis au sommet, fortement striés-ponctués; interstries convexes, finement et espacément ponctués. Dessous de même couleur; ponctuation plus forte sur le propectus que sur l'arrière-corps. Pattes brunes; 4e article petit et moins gros que les précédents.

Voisin de *M. inconditus* Candèze; plus brillant. Tête non carénée plus fortement ponctuée. Pronotum moins long; ponctuation plus grosse et moins serrée; carène externe des angles postérieurs plus rapprochee du bord latéral. Stries des élytres plus fortement ponctuées; interstries convexes et espacément pointillés. Hanches postérieurs moins anguleuses. 4e article des tarses également court et plus mince que les précédents.

Anchastus williamsi n. sp.

Negros, septembre (F. X. Williams). Un exemplaire, ma collection.

6 m/m ½.—Oblong, peu convexe; brun opaque; pubescence jaune. Tête peu convexe; ponctuation dense, ombiliquée. Antennes testacées filiformes; 3e article égal au 4e. Pronotum à peu près aussi long que large à la base, très faiblement courbe latéralement, légèrement rétréci en avant, peu convexe; ponctuation dense, ombiliquée; angles postérieurs robustes, non divergents, carénés en diagonale. Elytres subparallèles, arrondis et rétrécis dans le dernier tiers, fortement ponctués-striés; interstries finément rugueux. Dessous de même couleur. Pattes testacées.

Plus grand que *A. zwaluwenburgi* Fleutiaux; brun terne; antennes filiformes, 3e article égal au 4e et de même forme; ponctuation dense et ombiliquée.

Anchastus haddeni n. sp.

Luzon: Mt. Province, Mt. Saint Thomas; 6000 pieds, mars (F. C. Hadden). Un exemplaire, ma collection.

6 m/m ¾.—Oblong; brun, élytres plus clairs; pubescence jaune. Tête convexe; ponctuation ombiliquée grosse, large, superficielle et serrée. Antennes filiformes, atteignant la moitié du corps, brunes, deux premiers articles testacés; 3e égal au 4e. Pronotum à peu près aussi long que large à la base, trapézoïdal, peu convexe; ponctuation ombiliquée large, superficielle, assez serrée, effacée à la base; angles postérieurs aplatis et relevés, divergents, carénés. Elytres plus larges que le pronotum, arrondis et rétrécis seulement au delà de la moitié, peu convexes, striés-ponctués; interstries légèrement rugueux. Dessous de même couleur. Pattes longues, testacé pâle.

Plus étroit et moins convexe que *A. williamsi;* pronotum trapézoïdal, ponctuation moins serrée et moins profonde; élytres plus larges que le pronotum. Pattes plus longues.

Quasimus haddeni n. sp.

Luzon: Mt. Province, Baguio, 5000 pieds, mars (F. C. Hadden)—Baguio, juin (F. X. Williams)—Baguio (Baker) Mt. Saint-Thomas. Mindanao: Dapitan, Basilan. Ma collection, et H.S.P.A. Experiment Station de Honolulu.

2 m/m ¼ à 2 m/m ½.—Oblong; noir brilliant; pubescence grise très fine. Tête peu convexe; ponctuation fine, peu serrée. Antennes noires, épaisses, ne dépassant pas les angles du pronotum, hérissées de poils gris. Pronotum aussi long que large, peu rétréci en avant, peu convexe; ponctuation fine et peu serrée; carène des angles postérieurs prolongée jusqu'au bord antérieur. Elytres de la largeur du pronotum, subparallèles, arrondis au sommet, sans stries; ponctuation plus grosse que sur le pronotum, peu serrée, sans ordre. Dessous de même couleur. Sutures prosternales arquées et sillonnées, plus faiblement en arrière. Pattes noires.

Voisin de *Q. misellus* Boheman; moins large; aspect plus brillant; ponctuation beaucoup plus légère et moins dense.

Odontocardus rufus n. sp.

Mindanao: Dapitan; Surigao; Illigan; Bukidnon, Diklom, 2000 pieds, mars (F. C. Hadden). Ile Basilan; Negros: Monts Cuernos (Baker). Ma collection, et H.S.P.A. Experiment Station de Honolulu.

7½ à 10 m/m.—Oblong, subparallèle; testacé; pubescence jaune légère. Tête peu convexe; ponctuation légère; bord anterieur arrondi et rebordé. Antennes testacées, dépassant à peine les angles postérieurs du pronotum, subfiliformes; 2e article presque aussi long que le suivant. Pronotum aussi long que large, légèrement arrondi sur les côtés, à peu près également rétréci en avant et en arrière, peu convexe, brusquement déclive à la base; ponctuation fine et serrée; angles postérieurs aplatis, courts, arrondis au sommet, carénés latéralement; sillons basilaires courts, bien marqués; limites latérales inférieures, fines, effacées en avant. Elytres fortement ponctués-striés;

interstries plans, très finement et légèrement pointillés. Dessous de même couleur. Pattes plus claires.

Plus petit que *O. vitalisi* Fleutiaux; de forme plus parallèle, de couleur testacée; ponctuation du pronotum plus régulière et plus serrée.

Neodiploconus surdus n. sp.

Mindanao: Bukidnon, Tangcolan (Baker)—Bukidnon, Diklom, 2000 pieds, mars (F. C. Hadden). Ma collection, et H.S. P.A. Experiment Station de Honolulu.

12 à 13 m/m.—Allongé, atténué en avant et en arrière; brun mat; pubescence rousse. Tête impressionnée en avant, fortement et densément ponctuée. Antennes brunes, ne dépassant pas les angles postérieurs du pronotum, légèrement comprimés, faiblement serriformes à partir du 4e article; 2e et 3e petits, globuleux. Pronotum plus long que large, graduellement rétréci en avant, peu convexe, faiblement déprimé à la base, impressionné au milieu en arrière, densément et fortement ponctué; angles postérieurs longs, aigus, divergents, bicarénés. Elytres graduellement rétrécis en arrière, subtronqués au sommet, légèrement striés; interstries plans, finement et densément ponctués. Dessous de même couleur; ponctuation serrée. Pattes testacées.

Plus large que *N. umbilicatus* Candèze; moins convexe, atténué en avant et en arrière, aspect terne; tête largement impressionné en avant.

Neodiploconus nitens n. sp.

N. Luzon: Mt. Province, Camp 82, 6000 pieds, mai (F. C. Hadden). Ma collection, et H.S.P.A. Experiment Station de Honolulu.

12 à 13 m/m.—Allongé; noirâtre, brillant, élytres brunâtres; pubescence jaune assez longue, peu serrée. Tête fortement impressionnée en avant; bord antérieur avancé en bec arrondi; ponctuation grosse, peu profonde, très serrée. Antennes brunes, atteignant la moitié du corps, comprimées à partir du 4e article; 2e et 3e petits, globuleux. Pronotum un peu plus long que large, faiblement et graduellement rétréci en avant, déprimé; ponctuation forte et peu serrée; angles postérieurs relevés, aigus, divergents, brièvement carénés. Elytres plus larges que le pronotum à la base, graduellement atténués, subtronqués au sommet, peu convexes, très légèrement striés; interstries espacément pointillés. Dessous noir, finement et densément ponctué. Pattes brunes.

Très distinct par la tête avancée en bec arrondi; les antennes longues; les angles postérieurs du pronotum grêles; les élytres plus larges à la base que le pronotum.

Neodiploconus angustus n. sp.

Luzon: Mt. Province, Mt. Data; 5000 pieds, mars (F. C. Hadden). Un exemplaire, ma collection.

9 m/m.—Etroit; brun noirâtre brillant, plus clair aux angles postérieurs du pronotum et sur la suture des élytres; pubescence obscure, plus longue sur le pronotum. Tête arrondie et rebordée en avant, peu convexe, déprimée le long du bord antérieur, marquée d'une fossette au milieu; ponctuation assez grosse, peu serrée. Antennes brun clair, subfiliformes, atteignant la moitié du corps; 2e et 3e article petits, égaux. Pronotum plus long que large à la base, rétréci en avant, droit sur les côtés, peu convexe; assez fortement ponctué sur le bord antérieur, presque lisse sur le dos; angles postérieurs très déprimés, relevés et fortement ponctués, minces aigus, divergents, carénés tout près du bord externe. Elytres plus larges que le pronotum, atténués à partir de la base, conjointement terminés en pointe obtuse au sommet, légèrement striés. Dessous de même couleur. Pattes testacées.

Voisin de *N. nitens* Fleutiaux; plus étroit; bord antérieur de la tête plus arrondi; pronotum à ponctuation moins grosse, très espacée dans sa partie moyenne.

Agonischius praeustus n. sp.

Luzon: Laguna, Mt. Makiling, juin (F. C. Hadden). Un exemplaire, ma collection.

8 m/m ½.—Allongé; brillant; jaune, tête, une tache sur le milieu du pronotum en avant, écusson, premier et dernier interstries et extrémité des élytres noirs; pubescence noire dressée, peu serrée. Tête convexe, densément ponctuée. Antennes noires, serriformes, comprimées et élargies vers le bout; 3e article plus long que le 2e et de même forme. Pronotum aussi long que large à la base, rétréci en avant convexe; ponctuation peu serrée, forte en avant, légère sur les côtés et en arrière. Elytres atténués, légèrement ponctués-striés, plus distinctement vers l'extrémité; interstries plans et rarement pointillés. Propectus jaune; arrière-corps noir; pubescence grise. Pattes noires.

Appartient au groupe *A. pectoralis*, *A. sanguinipennis* Candèze.

Agonischius muzzalli n. sp.

Mindanao: Zamboanga, Kabasalan, mars (H. C. Muzzall).—Bukidnon, Tangcolan, Dapitan; Butuan; Basilan (Baker). Ma collection, et H.S.P.A. Experiment Station de Honolulu.

6 m/m.—Oblong, convexe; jaune, élytres bordés de noir latéralement dès le dessous de l'épaule, tête et milieu du pronotum parfois noirâtres sur la plus grande partie de la surface. Tête densément ponctuée. Antennes noires, premiers articles testacés. Pronotum aussi long que large, parallèle, arrondi en avant près des angles antérieurs, convexe, brusquement déclive à la base,

sillonné au milieu en arrière; angles postérieurs aigus, non divergents, carénés. Elytres arrondis sur les côtés et attenués, ponctués-striés. Dessous plus ou moins noirâtre, propectus parfois jaune. Pattes testacées.

Ressemble à *A. cardiorhinulus* Candèze; forme plus courte, pronotum plus convexe.

Silesis castaneus n. sp.

Mindanao: Zamboanga, Kabasalan, mars (H. C. Muzzall); Bukidnon, Diklom, 3000 pieds (F. C. Hadden). Ma collection, et H.S.P.A. Experiment Station de Honolulu.

9½ à 10 m/m.—Allongé; brun; pubescence jaune légère. Tête convexe, assez fortement et densément ponctuée. Antennes brunes, ne dépassant pas les angles postérieurs du pronotum, faiblement serriformes; 2e article court, globuleux. Pronotum plus long que large, parallèle, arrondi en avant, convexe, brusquement déclive à la base; ponctuation forte et assez serrée; angles postérieurs non divergents, carénés près du bord externe; sillons basilaires bien marqués. Elytres faiblement atténués, légèrement ponctués-striés; interstries plans, presque lisses. Dessous plus foncé; même pubescence légère. Pattes ferrugineuses.

Même forme que *S. cambodiensis* Fleutiaux; couleur moins foncée; hanches postérieures brusquement rétrécies en dehors.

Cicindelidae in the Collection of the Experiment Station of the Hawaiian Sugar Planters' Association, and in the Collection of Fred C. Hadden.

BY FRED C. HADDEN

(Presented at the meeting of March 2, 1933.)

The writer has recently rearranged the Cicindelidae in the collection of the Experiment Station, and in his collection. They have been arranged according to the "Coleopterorum Catalogus" Pars 86, 1926, by W. Horn, in the case of species *not* found in North America. The North American species were arranged according to the "Catalogue of the Coleoptera of North America, North of Mexico," 1920, by C. W. Leng.

Most of the European, South American, and tropical species were identified by Dr. Walther Horn of the Deutsches Entomologisches Museum, Gossler Strasse 20, Berlin-Dahlem, Germany. The North American species were identified by Dr. E. C. Van Dyke of the University of California, Berkeley, Calif., and by the writer.

A total of 302 species are represented in the two collections, of which 139 species are represented in the collection of the Experiment Station, and 258 species are in the writer's collection; 93 species are common to both collections.

Most of the specimens were collected by the following entomologists:

Dr. F. X. Williams—Collected in South America and in the Philippines.

Mr. C. E. Pemberton—Collected in Australia, New Guinea, Celebes, Borneo, and Malaya.

Mr. F. Muir—Collected in Malaya, China, Celebes, Amboina, Ceram, Borneo, and Japan.

Mr. J. E. A. Lewis—Collected in Japan.

Mr. T. B. Fletcher—Collected in India.

Mr. F. C. Hadden—Collected in California, Japan, Formosa, China, and in the Philippines.

Dr. G. A. C. Herklots—Collected in Hongkong, China.

Species without an *e* or *h* before their number are represented in both collections.

Species with an *e* before their number are represented only in the Experiment Station Collection.

Species with an *h* before the number are represented only in the Hadden Collection.

ALOKOSTERNALE PHYLE

Tribe 1. *CTENOSTOMINI*

e.	1	*Ctenostoma*	*unifasciatum* Dej.	Rio de Janeiro, Brazil	I-29-24

Tribe 2. *COLLYRINI*

	2	*Tricondyla*	*pulchripes* White	Foochow, China	VI-1-28
				Hongkong, China	X-6-31
h.	3	"	*punctulata* Chd.	Celebes	III-3-32
	4	"	*aptera* Ol.	New Guinea; Amboina	V-1-28
	5	"	*aptera* var. *globicollis* Chd.	Laguna, P. I.	V-1-31
	6	"	*aptera* var. *punctipennis* Chev.	Mindanao, P. I.	IV-16-31
	7	"	*aptera* var. *ovicollis* Mots.	Mt. Maquiling, Laguna P. I.	VII-16-30
	8	"	*cyanipes* Esch.	Laguna Prov., P. I.	V-19-31
	9	"	*cyanipes* var. *conicicollis* Chd.	Laguna Prov., P. I.	V-1-31
h.	10	"	*cyanipes* var. *brunnipes* Mots.	Borneo	
h.	11	*Neocollyris*	*brevilabris* W. H.	Laguna, P. I.	IV-16-31
h.	12	"	*redtenbacheri* W. H.	Dehra Dun, India	VIII-5-18
	13	"	*diardi* Latr.	Singapore	III-1-07
h.	14	"	*angularis* W. H.	Tayabas, Luzon, P. I.	VI-19-31
	15	"	*albitarsis* Er.	Laguna, Luzon, P. I.	V-19-31
e.	16	"	*celebensis* Chd.	Makassar, Celebes	XII-1-08
	17.	"	*bonelli* Guer.	Java	V-1-07
h.	18	"	*bonelli* var. *ortygia* Buq.	India	
	19	"	*emarginata* Dej.	Laguna, Luzon, P. I.	V-6-31
e.	20	"	*tuberculata* M'Leay	Java	V-1-29
e.	21	"	*apicalis* Chd.	Singapore	III-1-07
	22	"	*acrolia* Chd.	Laguna, Luzon, P. I.	V-1-31
h.	23	"	*affinis* W. H.	Luzon	
h.	24	"	*affinis* var. *similior* W. H.	Mindanao	
e.	25	"	*sarawakensis* Thoms.	Borneo	
e.	26	"	*arnoldi* M'Leay	Java	V-1-07

Tribe 3. *MEGACEPHALINI*

Subtribe 2. *OMINA*

h.	27	*Pycnochila fallaciosa* Chev.	Punta Arenas, Magellanes	
	28	*Amblychila cylindriformis* Say.	Kansas	
	29.	" *baroni* Riv.	Arizona	

(The following numbers 4, 5, 7, 9, etc., are as in Leng's catalogue)

e.	30-4	*Omus dejeani* Rche.		
e.	31-5	" *audouini* Rche.		
e.	32-7	" *ambiguus* Schp.		
h.	33-9	" *angusto-cylindricus* W. H.	Plumas Co., Calif.	VI-1-24
	34-12	" *californicus* Esch.	Berkeley, Calif.	IV-1-24
h.	35-15	" *cupreonitens* B. & R.	Humboldt Co., Calif.	VII-1-27
e.	36-17	" *edwardsi* Cr.		
e.	37-19	" *intermedius* Leng.		
	38-21	" *lecontei* Horn.	Monterey, Calif.	XII-21-24
	39-25	" *sequoiarum* Cr.	Plumas Co., Calif.	VI-14-24
e.	40-34	" *laevis* Horn.		

Subtribe 3. *MEGACEPHALINA*

	41	*Aniara sepulcralis* F.	Belem, Para.	V-1-24
h.	42	*Megacephala* (*Tetracha*) *euphratica* Latr. & Dej.	India	
h.	43	" *cylindrica* M'Leay	Australia	
h.	44	" *australis* Chd.	Australia	
h.	45	" *crucigera* M'Leay	Australia	II-1-27
	46	" (*Tetracha*) *carolina* L.	Texas	VIII-1-22
e.	47	" *carolina* var. *mexicana* Gray.		
h.	48	" *fulgida* Klug.	Paraguay	
	49	" *sobrina* var. *longipennis* Chd.	Belem, Para.	V-1-24
e.	50	" *brasiliensis* Kby.	Mexico	VII-1-24
	51	" *virginica* L.	Kansas	V-10-10
e.	52	*Oxychila gracillima* Bates	Mera, Ecuador	II-6-23
e.	53	*Pseudoxychila bipustulata* Latr.	Mera, Ecuador	I-25-23
	54	" *bipustulata* var. *ceratoma* Chd.	Mera, Ecuador	I-22-23
e.	55	*Chiloxia binotata* var. *longipennis* W. H.	Tena, Ecuador	IV-20-23

Tribe 5. *CICINDELINI*

Subtribe 2. *PROTHYMINA*

h.	56	*Prothyma paradoxa* W. H.	India	
	57	" *hopkinsi* W. H.	Mt. Maquiling, Luzon, P. I.	V-19-31
	58	" *hopkinsi* var. *bakeri* W. H.	Tayabas, Prov., Luzon	V-1-31

Subtribe 2. *PROTHYMINA* (Continued)

h.	59	*Prothyma hopkinsi* var. *aeneo-parva* W. H.	Tayabas, Prov., Luzon	V-1-31
	60	" *hopkinsi* var. *rotundato-cuprascens* W. H.	Biliran Isle, P. I.	VI-1-27
	61	*Dilatotarsa beccarii* Gestro.	Mountain Prov., P. I.	V-1-32
h.	62	" *patricia* Schm.	Celebes	III-3-32
	63	*Distipsidera flavicans* Chd.	Bundaberg, N. Q.	XII-1-04
e.	64	" *gruti* Pasc.	Hambledon, Australia	XI-1-21
e.	65	" *flavipes* M'Leay	Halifax, N. Q.	IV-1-20

Subtribe 3. *THERATINA*

	66	*Therates labiatus* F.	Piroe, Ceram	I-1-09
	67	" *labiatus* var. *coracinus* Er.	Mt. Maquiling, P. I.	V-1-31
h.	68	" *labiatus* var. *fulvipennis* Chd.	Mindanao	
h.	69	" *labiatus* var. *everetti* Bates	Mindanao	
h.	70	" *labiatus* var. *sudans* W. H. (=*fulvipennis* Chd.)	Mindanao	
	71	" *basalis* Dej.	Koitaki, New Guinea	XI-1-28
	72	" *semperi* Schm.	Mt. Maquiling, P. I.	IV-1-31
h.	73	" *fasciatus* F.	Basilan, P. I.	
h.	74	" *fasciatus* var. *nigrosternalis* W. H.	Davao, Mindanao, P. I.	
h.	75	" *fasciatus latreillei* Thoms.	Celebes	III-3-32
e.	76	" *dimidiatus* var. *wallacei* Thoms.	Borneo	
	77	" *batesi* Thoms.	Borneo	X-1-07
e.	78	' *erinys* Bates	Borneo	X-1-07
	79	" *schaumianus* var. *flavo-ornata* W. H.	Borneo	X-1-07
e.	80	" *princeps* Bates	Borneo	X-1-07

Subtribe 4. *ODONTOCHILINA*

e.	81	*Odontochila nodicornis* Dej.	Brazil	IV-1-24
	82	" *cayennensis* F.	Mera, Ecuador	I-25-23
e.	83	" *cayennensis* var. *bipunctata* F.	Tena, Ecuador	II-14-23
	84	" *trilbyana* Thoms.	Mera, Ecuador	I-25-23
e.	85	" *batesi* var. *castelnaui* Luc.	Tena, Ecuador	III-27-23
	86	" *vermiculata* Bates	Tena, Ecuador	III-27-23
e.	87	" *mexicana* Cast.	?	
	88	" *luridipes* var. *aperta* Klug.	Para.	V-1-24
e.	89	" *margineguttata* Dej.	Trinidad	VII-1-23
	90	" *chrysis* F.	Blairmont, B. G.	X-1-23
e.	91	" *cupricollis* Koll.	Brazil	II-2-24
e.	92	*Heptodonta analis* F.	Borneo	X-1-07
	93	" *melanopyga* Schm.	Luzon, P. I.	V-1-31
e.	94	*Prepusa punctum* Klug.	Brazil	III-1-24

Subtribe 5. *CICINDELINA*

h. 95	*Cicindela melancholica* F.			
h. 96	"	*sexpunctata* F.	Burma	X-18-24
h. 97	"	*brevicollis* var. *clathrata* Dej.		
h. 98	"	*stenodera* Schm.	Celebes	
99	"	*mandibularis* Schm.	Laguna, P. I.	V-19-32
h. 100	"	*fugax* Schm.	Tayabas, P. I.	VI-25-30
h. 101	"	*conspicua* Schm.	Mt. Maquiling ?, P. I.	
102	"	*clara* Schm.	Tayabas Prov., P. I.	VI-19-31
103	"	*clara* var. *aenula* W. H.	Mt. Maquiling, P. I.	V-19-31
104	"	*clara* var. *rugothoracica* W. H.	Mountain Prov., P. I.	V-1-32
h. 105	"	*virginea* var. *interposita* W. H.	Tayabas, P. I.	VI-19-31
h. 106	"	*sauteri* W. H.	Formosa	VI-26-27
h. 107	"	*delavayi* var. *funebris* Schmt.-Goeb.	Assam	V-20-25
h. 108	"	*dromicoides* Chad.	India	VII-1-24
109	"	*triguttata* Hbst.	Laguna, P. I.	V-14-31
h. 110	"	*holosericea* F.	Semarang, Java	X-1-05
111	"	*pseudo-nana* W. H.	Tayabas, P. I.	V-6-32
h. 112	"	*nana* Schm.		
h. 113	"	*spinolai* Gestr.	Dehra-Dun, India	V-15-25
114	"	*psilica* Bates	Taihoku, Formosa	V-20-27
115	"	*macilenta* Schm.	Laguna, P. I.	V-29-31
116	"	*minuta* Ol.	Pusa, India; Java	VII-1-07
117	"	*elisae* Mots.	Sapporo, Japan	VII-20-27
118	"	*elisae* var. *reducte-lineata* W. H.	Taihoku, Formosa	V-6-28
119	"	*venosa* Koll.	Pusa, India	
120	"	*excisa* Schm.	Zamboanga, P. I.	VI-1-32
121	"	*grammophora* Chd.	Pusa, India	
122	"	*specularis* Chd.	Kobe, Japan	VII-1-17
h. 123	"	*foveolata* Schm.		
124	"	*sumatrensis* Hbst.	Los Banos, Laguna, P. I.	VII-2-31
h. 125	"	*angulata* F.	Dehra Dun, India	III-25-25
h. 126	"	*chloris* Hope	Dehra Dun, India	VII-20-25
h. 127	"	*funerea* M'Leay	Burma	X-27-21
h. 128	"	*funerea* var. *assimilis* Hope	Sikkim	
129	"	*lunulata* F.		
130	"	*lunulata* var. *nemoralis* Ol.		
131	"	*discreta* Schm.	Celebes	III-3-32
132	"	*kaleea* Bates	Taihoku, Formosa	VII-14-27
e. 133	"	*semicincta* Brullé.	Koitaki, New Guinea	XII-1-28
134	"	*lacrymosa* Dej.	Laguna, P. I.	V-19-31
135	"	*decemguttata* F.	Amboina; Java	V-1-08
h. 136	"	*intermedia* Chd.	Mussoorie	V-28-21
h. 137	"	*duponti* Dej.	Annam	
138	"	*aurulenta* F.	Borneo	VIII-1-09

Subtribe 5. *CICINDELINA* (Continued)

139	*Cicindela aurulenta* var. *flavomaculata* Chev.		Hongkong	VI-1-31
140	" *aurulenta batesi* Fleut.		Taihoku, Formosa	VII-9-27
141	" *chinensis* Geer.		Foochow, China	VI-16-31
142	" *chinensis* var. *japonica* Thunb.		Mt. Rokko, Japan	VII-7-28
143	" *heros* F.		Celebes	III-3-32
144	" *striolata* Ill.		India	II-18-32
h. 145	" *striolata* var. *dorsolineolata* Chev.		Hongkong	VI-16-31
146	" *striolata* var. *tenuiscripta* Fleut.		Laguna, P. I.	V-19-31
h. 147	" *striolata* var. *lineifrons* Chd.		India	V-10-25
e. 148	" *fuliginosa* Dej.		Java	XI-30-08
149	" *cancellata* var. *subtilesculpta* W. H.		Formosa	VI-14-27
150	" *biramosa* F.		Saigon	
h. 151	" *nivicincta* Chev.	(Riu Kiu)	Luchu Islands	V-30-14
152	" *vitiensis* Bl.		Rewa, Fiji	III-3-06
153	" *funerata* Boisd.		Koitaki, N. G.	X-16-28
e. 154	" *guineensis* W. H.		Laloki, Papua	II-2-10
h. 155	" *waiouraensis* Broun.		Marlborough, N. Z.	II-12-14
h. 156	" *austromontana* Bates		Awatere, N. Z.	II-14-16
h. 157	" *perhispida* Broun.		N. Z.	
e. 158	" *argentata* F.		Belem, Para.	V-1-24
h. 159	" *soluta* Dej.		Budapest	
h. 160	" *silvatica* L.			
h. 161	" *silvatica* var. *similis* Westh.			
h. 162	" *silvatica* var. *fennica* Beuth.			
h. 163	" *silvatica* var. *virescens* Beuth.			
164	" *japana* Mots.		Kobe, Japan	VI-9-28

(Nos. 165-210, mostly European species. Locality data not available.)

e. 165	" *sachalinensis* Moraw.
h. 166	" *silvicola* Dej.
h. 167	" *gallica* Brullé.
h. 168	" *hybrida* L.
h. 169	" *hybrida* var. *monasteriensis* Westh.
h. 170	" *hybrida* var. *riparia* Dej.
h. 171	" *hybrida* var. *sibirica* Fisch.
h. 172	" *hybrida* var. *maritima* Dej.
h. 173	" *hybrida* var. *virescens* Ev.
h. 174	" *hybrida* var. *hamifasciata* Kolbe.
h. 175	" *hybrida* var. *nitida* Licht.
h. 176	" *granulata* Geb.
177	" *campestris* L.
h. 178	" *maura* L.
h. 179	" *maura* var. *recta* Krtz.
h. 180	" *galatea* Thieme.
h. 181	" *germanica* L.
h. 182	" *germanica* var. *deuteros* Dall. T.
h. 183	" *germanica* var. *obscura* F.
h. 184	" *germanica* var. *angustata* Mots.
h. 185	" *germanica* var. *sobrina* Gory.

Subtribe 5. *CICINDELINA* (Continued)

h. 186 *Cicindela germanica* var. *martorelli* Krtz.
h. 187 " *germanica* var. *descendens* Fisch.
h. 188 " *gracilis* Pal.
h. 189 " *lyoni* var. *latreillei* Dej.
h. 190 " *deserticola* Fald.
h. 191 " *elegans* var. *stigamtophora* Fisch.
h. 192 " *circumdata* Dej.
h. 193 " *circumdata* var. *dilacerata* Dej.
h. 194 " *chiloleuca* Fisch.
h. 195 " *arenaria* var. *lugdunensis* Dej.
h. 196 " *arenaria* var. *viennensis* Schr.
h. 197 " *arenaria* var. *litterata* W. H.
h. 198 " *contorta* Fisch.
h. 199 " *trisignata* Dej.
h. 200 " *lunulata* F.
h. 201 " *lunulata* var. *littoralis* F.
h. 202 " *fischeri* Adams.
h. 203 " *fischeri* var. *alasanica* Mots.
h. 204 " *concolor* Dej.
h. 205 " *caucasica* Adams.
h. 206 " *sturni* Ment.
h. 207 " *flexuosa* F.
h. 208 " *flexuosa* var. *lunata* Beuth.
h. 209 " *flexuosa* var. *sardea* Dej.
h. 210 " *truquii* Guer.

North American Species

(Second figure is number in Leng's catalogue.)

211-39	*Cicindela formosa* Say.	Texas	IV-1-28
h. 212-39b	" *formosa* var. *generosa* Dej.	Chicago, Ill.	VII-1-29
h. 213-40	" *lengi* W. H.	Medora, Kansas	
214-41	" *limbata* Say.	Wallace, Neb.	VII-7-31
215-42	" *purpurea* Oliv.	Minnesota	V-30-11
216-42b	" *purpurea* var. *graminea* Schp.	Utah	V-6-28
e. 217-42a	" *purpurea* var. *auduboni* Lec.		
218-44	" *splendida* Hentz.	Hope, Arkansas	X-10-30
h. 219-45	" *limbalis* Klug.	Jeannette, Pa.	
220-45a	" *limbalis* var. *amoena* Lec.	Mt. Pleasant, Iowa	IV-4-28
221-48	" *ancocisconensis* Harr.	Buffalo, N. Y.	
222-49	" *duodecimguttata* Dej.	Alaska	VI-18-28
h. 223-49c	" *duodecimguttata* var. *bucolica* Csy.	Hennepin Co., Minn.	VII-6-10
224-50	" *repanda* Dej.	Medora, Kans.	VI-25-16
225-51	" *hirticollis* Say.	Lake Forest, Ill.	V-30-30
h. 226-51a	" *hirticollis* var. *ponderosa* Thoms.	N. J.	
h. 227-51d	" *hirticollis* var. *gravida* Lec.	Arizona	

Subtribe 5. *CICINDELINA* (Continued)

228-52	*Cicindela latesignata* Lec.	Huntington Beach, Calif.	VIII-6-28
h. 229-52b	" *latesignata* var. *tenuicincta* Blaisd.	Huntington Beach, Calif.	XI-12-30
h. 230-53	" *tranquebarica* Hbst.	Medora, Kans.	V-7-16
e. 231-	" *tranquebarica* var. *vulgaris* Say.		
e. 232-	" *tranquebarica* var. *obliquata* Kby.		
h. 233-55	" *vibex* Horn.	Plumas Co., Calif.	VI-20-24
h. 234-55a	" *vibex* var. *viridissima* Fall.	Plumas Co., Calif.	VI-20-24
h. 235-57	" *tenuicincta* Schp.		
h. 236-59	" *longilabris* Say.	Tahoe, Calif.	VII-13-15
h. 237-59b	" *longilabris* var. *montana* Lec.	Salt Lake City, Utah	V-6-28
h. 238-59h	" *longilabris* var. *perviridis* Schp.	Tahoe, Calif.	VII-13-15
h. 239-60	" *eureka* Fall.	Humboldt Co., Calif.	V-4-11
240-61	" *oregona* Lec.	Plumas Co., Calif.	VI-26-24
h. 241-61b	" *oregona* var. *maricopa* Leng.	Arizona	
h. 242-62	" *depressula* Csy.	Angora Peak, Tahoe Calif.	VII-15-15
h. 243-63	" *senilis* Horn	Millbrae, Calif.	X-3-14
h. 244-64b	" *willistoni* var. *pseudosenilis* W. H.	Calif.	I-17-17
h. 245-65	" *fulgida* Say.	Grand Canyon, Ariz.	IX-1-29
h. 246-65b	" *fulgida* var. *remittans* Csy.	Lind, Wash.	V-15-32
h. 247-66	" *pulchra* Say.	Hamilton Co., Kans.	VI-1-02
e. 248-67	" *pimeriana* Lec.		
h. 249-68	" *scutellaris* Say.	Wallace, Neb.	VII-7-31
250-68a	" *scutellaris* var. *lecontei* Hald.	Lake Co., Ill.	V-31-30
h. 251-68c	" *scutellaris* var. *rugifrons* Dej.	Lakehurst, N. J.	VII-1-29
h. 252-68e	" *scutellaris* var. *unicolor* Dej.	Forestburg, Texas	III-3-28
h. 253-68g	" *scutellaris* var. *modesta* Dej.	Lakehurst, N. J.	IX-1-29
254-69	" *sexguttata* Fab.	Illinois	VII-7-29
h. 255-69b	" *sexguttata* var. *violacea* Fab.	Kansas	VI-10-22
256-70	" *patruela* Dej.	Rockville, Pa.	X-5-25
h. 257-70a	" *patruela* var. *consentanea* Dej.	Lakehurst, N. J.	VII-30-22
h. 258-83a	" *vulturina* Lec.	New Mexico	VIII-4-09
259-74	" *punctulata* Oliv.	Wallace, Neb.	VII-7-31
e. 260-	" *punctulata* var. *micans* Fab.		
h. 261-78	" *lemniscata* Lec.	Globe, Ariz.	VII-1-21
h. 262-79	" *abdominalis* Fab.	Lakehurst, N. J.	VII-1-29
h. 263-80	" *politula* Lec.	Texas	
h. 264-81	" *rufiventris* Dej.	Rockville, Pa.	VII-23-12
h. 265-81b	" *rufiventris* var. *hentzi* Dej.	Mass.	VII-13-27
h. 266-82	" *sedecimpunctata* Klug.	Gila Co., Ariz.	VII-1-29
h. 267-83	" *flavopunctata* Chev.	Tucson, Ariz.	X-1-27
h. 268-84	" *marginipennis* Dej.		
269-86e	" *carthagena* var. *haemorrhagica* Lec.		
h. 270-86e	" *carthagena* var. *pacifica* Schp.	Naples, Calif.	VIII-4-16

Subtribe 5. *CICINDELINA* (Continued)

h. 271-88	*Cicindela arizonensis* Bates	Tucson, Ariz.	VII-21-13
h. 272-87	" *sommeri* Mann.	Iowa	VI-1-05
h. 273-89	" *wickhami* W. H.		
h. 274-92	" *cursitans* Lec.	Iowa	VI-11-05
275-93	" *unipunctata* Fab.	Cave Mts., Pa.	VIII-6-14
276-94a	" *pusilla* var. *imperfecta* Lec.	Ritzville, Wash.	VII-1-23
h. 277-96	" *circumpicta* Laf.	Lincoln, Neb.	VIII-12-32
h. 278-97a	" *californica* var. *praetextata* Lec.	Gila Co., Ariz.	VIII-1-31
h. 279-98	" *trifasciata* Fab.		
h. 280-98	" *trifasciata* var. *tortuosa* Lec.	Everglade, Fla.	V-12-12
281-98b	" *trifasciata* var. *sigmoidea* Lec.	Naples, Calif.	VIII-11-16
h. 282-99	" *gabbi* Horn.	Seal Beach, Calif.	IX-1-27
h. 283-101	' *dorsalis* Say.	Long Beach, L. I., N. Y.	VII-10-12
h. 284-101d	" *dorsalis venusta* Laf.	Galveston, Texas	VI-14-22
h. 285-103	" *hamata* A. & B.	Vera Cruz, Mex.	
h. 286-104	" *marginata* Fab.	New York	
h. 287-107a	" *nevadica* var. *knausi* Leng.	Eastland Co., Tex.	VI-1-21
h. 288-108a	" *cuprascens* var. *macra* Lec.	Forestburg, Tex.	VI-1-27
h. 289-108b	" *cuprascens* var. *puritana* Horn	Maryland	VII-1-29
h. 290-109	" *sperata* Lec.	Texas	
h. 291-110	" *lepida* Dej.	Wallace, Neb.	VII-7-31
h. 292-111c	" *togata* var. *apicalis* W. H.	Lincoln, Neb.	VI-1-25
h. 293	' *arida* Davis (Paratype)	Death Valley, Calif.	III-31-28
e. 294-113	" *pilatei* Guer.		
e. 295-114	" *belfragei* Sallé.		

South American Species

e. 296	*Cicindela chrysamma* Bates	Tena, Ecuador	IV-5-23
e. 297	" *trifasciata* var. *tortuosa* Dej.		
h. 298	" *trifasciata* var. *peruviana* Cast.	La Serena	I-25-29
h. 299	" *apiata* Dej.	Buenos Aires	I-1-30
h. 300	" *drakei* var. *pseudochiloleuca* W. H.	Argentine	
h. 301	" *chiliensis* A. & B.	Santiago	I-24-29
h. 302	" *macrocnema* var. *obliquans* Chd.	Panama	I-3-11

Notes on the Feeding Habits of Scolopendra subspinipes Leach (Myriopoda)

BY THOMPSON C. LAWRENCE

(Presented by Dr. Williams at the meeting of June 1, 1933)

One evening, when it was quite dark, I was approaching a street lamp, when I observed a large centipede with its mouth applied to a slug, *Veronicella leydigi* Simroth. The slug was contracted, and lying on its back. I poked the centipede, causing it to run about eight inches away from the victim. However, it completed the loop it was making by returning to the motionless slug and again applying its mouth to it. I again drove the centipede off, but it hid in the weeds and did not return while I was there.

As there is nothing in the Islands which, as far as I know, kills these leathery slugs except man and possibly these centipedes, I became interested in finding out whether Scolopendra eats these pests. To find out definitely whether the centipedes will kill Veronicella, I resolved on an experiment. Having procured a round tin can about six inches across and two-thirds as high, I set about turning up stones to locate a centipede. Having caught one, I put it in the can with a very large grey sphinx moth. This was a very foolish move, as after the centipede had eaten nearly all the moth except the eggs and appendages it would not eat for a week. I also put in a fair sized slug, about two inches long when expanded, as this was approximately the size of the one I had seen on the walk. In addition I put in some grass, weeds, and lettuce leaves. The slug was there for about four days, and every day I looked and found it alive. There were also many ants eating the remains of the moth. Then I was gone over the week-end and when I returned the slug was mouldy, limp and smelly, so I threw it out. I kept the centipede, however.

I next put in two half-grown sugar-cane grasshoppers and two slugs, one the small, brown, slimy variety very common under stones, then another *Veronicella leydigi* and more fresh lettuce. The centipede seemed to fear the grasshoppers and hid its head under the grass. That night both grasshoppers were gone. Con-

sidering the small size of the container, however, the grasshoppers were at a disadvantage not occurring under natural conditions. The next day I found the small slug dead, with its head reddish and protruding from under its mantle. I could find no wounds on it and threw it out. Under similar conditions I believe that other slugs of the same kind would live several days. The centipede was not eating it when I found it. Next I put in some papaya for the slug, and to my surprise the centipede seemed to nibble some of it. I had kept the box damp during the whole experiment, for the slugs' sake, so the centipede was not merely thirsty.

Returning from the next week-end I found the Veronicella dead but quite fresh, with a gash such as might have been cut by a razor straight across the broad white line on its ventral side. The slug was not much contracted. Its insides could be squeezed out through the hole. The centipede was not eating it, but no ants would have made such a hole. Also no ants were trying to eat the slug, as it was quite slimy. The next day I considered the case closed and threw out the contents of the can. The centipede was still quite active.

Mr. Olsen told me that the case was not proven due to the fact that I had not seen a Scolopendra actually kill a live slug. Due to pressure of studies I had no time to do this. However, I hope to do it before I leave here, by following Mr. Olsen's advice, namely, to starve the centipede about a week and then, in a dim light, to put a slug into the container with it.

Nevertheless, the evidence is almost sufficient to indicate that the centipede has a wide range of diet, including, among other things, slugs, certain kinds of fruit pulp, and at least some of the Orthoptera.

New Thysanoptera of the Hawaiian Islands

BY DUDLEY MOULTON, SAN FRANCISCO, CALIF.

(Presented by O. H. Swezey at the meeting of September 7, 1933)

This paper includes the description of one new genus, four new species and three known species which have not heretofore been recorded as found in the Hawaiian Islands. The many collections which have been examined since the publication of my former paper in 1928 have included many of the already listed and known species but these records are not included here. I wish to express my appreciation to Messrs. Fullaway, Swezey, Williams, Illingworth, Carter, K. Sakimura, and K. Ito for collections and the interest which they have shown.

TEREBRANTIA

Family THRIPIDAE Uzel, 1895.

Subfamily HELIOTHRIPINAE Karny, 1921.

Hercothrips femoralis Reuter.

Adults, larvae and pupae taken on pineapple, tomato, red beets and other plants in greenhouses on June 27, 1930. K. Sakimura. Manoa, Oahu. Moulton No. 4341.

Subfamily CHIROTHRIPINAE Karny.

Anaphothrips (Anaphothrips) swezeyi Moulton.

Taken on grass March 26, 1929, at Kailua, Oahu, by O. H. Swezey, Moulton No. 3570. Also on *Panicum barbinode* and other grasses, June 8, 1930, by K. Sakimura. Moulton Nos. 4344 and 4345.

Subfamily THRIPINAE Karny, 1921.

STULOTHRIPS Moulton new genus.

Head wider than long; eyes large, globular with coarse facets; ocelli present in both sexes; interocellar spines long. Prothorax longer and wider than head, without spines at anterior angles, with three spines at each pos-

terior angle, the middle one being somewhat shorter than the others. Abdomen broad, tergites one to six each with a comblike arrangement of setae at sides, posterior margins of seven and eight with complete comb; terminal spines on ninth and tenth segments long and strong. Antenna with eight segments, three and four sub-ovate and with short, stocky, forked sense cones, segment five small and joining broadly with the longer sixth; style as long as segment six, composed of two segments, the first very short, the second approximately five times longer. Legs with tibiae and tarsi unarmed. Wings fully developed in both sexes; fore wing with two longitudinal veins, fore vein almost regularly and hind vein regularly set with spines. Mouth-cone short, maxillary palpus with three segments.

Stulothrips trespinus n. sp.

Female holotype: Dark brown, head and abdomen darker, thorax yellowish brown and with orange pigment; antennal segments brown except three and four which are yellow; all legs yellow; fore wings clear in basal quarter, otherwise brown, hind wings slightly grayish, each with a dark median line extending to near tip; crescents of ocelli deep red; prominent body spines brown.

Total body length 1.4 mm.; head length 0.132 mm., width 0.19 mm.; prothorax length 0.176 mm., width 0.26 mm., pterothorax width 0.35 mm., abdomen width 0.41 mm. Antennal segments length (width) I, 20 (33); II, 30 (30); III, 53 (23); IV, 43 (23); V, 36 (16); VI, 53 (20); VII, 10; VIII, 50; total 300 microns. Length of spines: interocellars 63, on posterior angle of prothorax, outer 76, median 66, inner 90 microns; on ninth and tenth abdominal segments 150 microns.

Male allotype colored as in female but with thorax orange yellow, head and abdomen brown, fifth antennal segment also yellowish in basal half. Total body length 0.95 mm. Depressions on sternites transversely ovate.

Interocellar spines are placed immediately behind anterior ocellus and within the ocellar triangle. This genus Stulothrips is especially characterized by having three well developed spines at each posterior angle, the pronotum has many small setae over its surface and four on either side along the posterior margin of which the innermost is longest. Abdominal segments one to six have comblike setae at the sides and a complete comb along the posterior margins of seven and eight. Antennal segment five is relatively small, six much longer, seven exceedingly small and eight about five times longer than seven and almost equal in length to segments three and six. The sense cones on three and four are forked but short and stout. The fore vein of each fore wing has about twenty-two spines more or less regularly placed, the fifteen on the hind vein are placed regularly.

Type material: female holotype, male allotype, four female and eight male paratypes, many larvae and pupae, taken on *lauhala* September 8, 1930. K. Sakimura. Moulton No. 4346. Holotype and allotype in author's collection, paratypes deposited in the collection of the Hawaiian Entomological Society, Honolulu.

Type locality: Hauula, Oahu, Territory of Hawaii.

TUBULIFERA

Family PHLOEOTHRIPIDAE Uzel, 1925.

Subfamily PHLOEOTHRIPINAE Priesner, 1927.

Tribe *Hoplothripini* Priesner, 1927.

Poecilothrips biformis n. sp.

Female holotype: Head brown, sides of thorax and abdomen light brown, median portion of thorax and abdomen yellowish brown, tube brownish yellow, darker in basal half. Antennal segments uniformly brown except tip of two and extreme base of three which are yellowish; legs with all femora brown, tibia and tarsi yellow, with tibia shaded light brown at the sides; wings grayish, lighter in the middle giving them the appearance of being somewhat narrowed.

Total body length 1.8 mm.; head length 0.22 mm., width near base 0.176 mm.; prothorax length 0.11 mm., width 0.26 mm.; tube length 0.13 mm., width at base 0.088 mm. Antennal segments length (width) I, 30 (36); II, 43 (33); III, 60 (31); IV, 50 (30); V, 50 (26); VI, 46 (23); VII, 43 (23); VIII, 43, total 360 microns. Length of spines: postoculars 73, on anterior margin of prothorax 60, on anterior angles, midlaterals and on posterior angles 73, on ninth abdominal segment 166, at tip of tube 133 microns.

Sides of head almost parallel or slightly widened posteriorly, eyes globular, ocelli fully developed, mouth cone sharply pointed, postoculars and other prominent body spines transparent and with dilated tips; abdominal segments three to eight each with a dark transverse line at anterior third which is broken in four to six places by white spots shaded brown at the sides; abdominal segments three to seven each with two pairs of well developed wing-holding spines. Antennal segments three to eight each with a pedicel, eight being clearly separated from seven; third segment with two sense cones Legs slender, fore femora slightly enlarged, tarsi unarmed. Each fore wing with four double fringe hairs.

Female paratype, wingless form: colored as in winged form except that head is lighter, yellowish in the middle and shaded brown at the sides. Total body length 1.8 mm. Eyes very small occupying only anterior border of head at sides of antennae, with only two or three facets in outline; ocelli wanting. Transverse brown lines on abdominal segments three to eight present, wing-holding spines vestigial.

Type material: female holotype and three female paratypes one of which is the wingless form, taken on an old stump March 12, 1929. O. H. Swezey. Moulton No. 3565. One paratype deposited in the collection of the Hawaiian Entomological Society, Honolulu, other types in author's collection.

Type locality: Honolulu, Territory of Hawaii.

The two forms, with and without wings, could easily be mistaken for different species and display an interesting variation which is extremely rare.

Tribe *Haplothripini* Priesner

Haplothrips gowdeyi Franklin.
Syn. **Haplothrips usitatus** Bagnall.

Haplothrips gowdeyi was described by Franklin in 1908 from specimens taken in Barbados Islands and Europe. *H. usitatus* was described by Bagnall from specimens taken in the Hawaiian Islands in 1910. This species is one of the most common in the islands and has been taken from many host plants.

Haplothrips (Karnyothrips) melaleuca Bagnall, 1911.

This species was originally found in the Palm House of the Botanical Gardens at Copenhagen, Denmark, and has since been taken on the island of Trinidad near South America. This new finding is especially interesting as Mr. Illingworth reports that it is always taken in the feeding area of red spider on pineapple leaves and believes that it is predacious on these spiders. (Moulton No. 4059.) Mr. Carter's specimens (Moulton Nos. 4311-4314), were also taken from pineapple leaves.

Haplothrips (Hindsiana) williamsi n. sp.

Female holotype: Head, thorax and tube yellowish brown, abdomen light brownish yellow; antennal segments one and four to eight brown, two and three light brownish yellow; legs yellow; wings light gray.

Total body length (abdomen distended) 1.9 mm.; head length 0.16 mm., width 0.13 mm.; prothorax length 0.10 mm., width 0.18 mm.; tube length 0.10 mm. Antennal segments length (width) I, 23 (26); II, 36 (26); III, 36 (26); IV, 43 (26); V, 43 (23); VI, 36 (20); VII, 36; VIII, 23; total 283 microns. Length of spines: postoculars 40, on anterior angles of prothorax 30, midlaterals 33, on posterior angles, outer 52, inner 40, on ninth abdominal segment 116, at tip of tube 133 microns.

The third antennal segment is short and bears two sense cones, seven and eight are broadly joined; prominent head and body spines have dilated tips; all legs are slender, tarsi are unarmed; fore wings have five or six double fringe hairs.

This species has the general appearance of *H. (Karnyothrips) melaleuca* Bagnall but is easily separated by the unarmed fore tarsi, more compact antennal segments and the uniformly brown coloring of segments four to eight. *H. dodgei* Hood has femora darkened with brown on the outside and the fourth antennal segment lighter than five.

Type material: female holotype and seven female paratypes taken from under bark of "Maba," December 16, 1929. F. X. Williams. Moulton No. 3922. Paratype deposited in the collection

of the Hawaiian Entomological Society, Honolulu, holotype and other paratypes in author's collection.

Type locality: Hualalai, Territory of Hawaii.

Subfamily MEGATHRIPINAE Karny, 1921

Tribe *Megathripini* Priesner, 1927.

Dichaetothrips claripennis n. sp.

Female holotype: Dark brown, with median portions of abdominal segments one to five lighter; fore tibiae brownish yellow, darker at the sides, fore tarsi yellow; third antennal segment brownish yellow, shaded darker toward tip, fourth segment yellowish brown; wings clear.

Total body length 2.8 mm. Head length 0.30 mm., width 0.26 mm.; prothorax length 0.19 mm., width 0.38 mm.; tube length 0.29 mm., width at base 0.10 mm. Antennal segments length (width) I, 26 (40); II, 60 (36); III, 100 (40); IV, 100 (40); V, 83 (33); VI, 60 (33); VII, 50 (26); VIII, 33; total 530 microns. Length of spines: postocellar 50, postocular 106; prothorax, at anterior angles 46, on anterior margin 33, midlaterals 50, on posterior angles, outer 93, inner 93; on ninth abdominal segment 283 and at tip of tube 250 microns. Basal wing spines 56, 66 and 93 microns.

Head 1.25 times longer than wide, broad and flattened in front, cheeks very slightly swollen at the sides and very slightly narrowed at the base; cheek spines minute; third and fourth antennal segments equal, three with two and four with four sense cones; seventh and eighth segments closely joined. Each fore tarsus armed with a stout pointed tooth. Fore wings with seventeen or eighteen double fringe hairs.

Type material: female holotype found on a table, February 5, 1930 (F. X. Williams). Moulton No. 3907. Type in author's collection.

Type locality: Honolulu, Territory of Hawaii.

This species is separated from the other known species by its relatively shorter head and clear wings.

Superfamily UROTHRIPOIDEA Hood, 1915

Family UROTHRIPIDAE Bagnall, 1909.

Stephanothrips occidentalis H. & W.

One specimen taken on *Paspalum orbiculare,* June 16, 1930, at Paumalu, Oahu, by K. Sakimura.

PRESIDENTIAL ADDRESS

Some Future Work for the Entomologist in Hawaii

BY C. E. PEMBERTON

(Presented at the meeting of December 7, 1933.)

With this, our 335th meeting, The Hawaiian Entomological Society concludes its 29th year as an active organization. Thanks to the generosity and foresight of the trustees of the Hawaiian Sugar Planters' Association in materially helping to finance the publication of our Proceedings, we have reached our 8th volume of printed matter and can justly look with pride to the achievement. Our present active membership includes individuals professionally employed in economic, museum, quarantine, teaching and survey work, several men engaged in other business and a number of retired entomologists whose enthusiasm for the work goes on with unabated ardor. In the particular work each may be concerned with, this multiude of published records on almost every detail of work in Hawaii for 29 years offers facts which unquestionably further his efforts in the puruit of knowledge, whether it be for the advancement of his economic work, for historical purposes, pure science, or for pleasure. Let us hope the printing of these records may continue.

Though our island group is a small one, with a total land area of about 6449 square miles, of great isolation and with an exceptionally limited insect fauna, each year shows no diminution in the amount of entomological work done. New immigrant species continue to appear in our midst and new endemic species are frequently added to our list. With the paucity of our native fauna and the great strides accomplished in the biological control of many of our worst immigrant pests, the feeling has been expressed in some circles that an entomological holiday is in order in Hawaii; that this branch of zoölogical science has been pushed far enough and that present costs are not in keeping with the returns. In anticipation of the growth of such a sentiment, the present subject has been chosen.

Proc. Haw. Ent. Soc., VIII, No. 3, July, 1934.

As years pass and commerce and human populations increase, transportation facilities will improve both in speed and quantity. The need for entomological service in Hawaii will then be greater rather than less. More trained men than we have today will be necessary if we expect to retain the beauty of our ornamental trees, shrubs and other plants, and continue the magnificent record with our major agricultural crops. Our geographical position with consequent small insect fauna clearly accounts for our blissful but precarious state, as has been frequently explained by entomologists in the past. There are few tropical or semitropical places in the world today, if any, where an immigrant insect has such an excellent opportunity to run rampant as in Hawaii, providing ecological conditions are suitable for its existence. The richness of parasitic and predatory enemies, together with other checks both bacterial and fungous, which are operative against insect life in most other tropical parts of the world, offer possibilities of at least partial protection to the tropical planter against devastating uprisings of imported pests. Such factors of protection, natural to Hawaii, are by comparison few in number. Many cases could be cited to illustrate this point. We select two. Our sugar cane leaf hopper *Perkinsiella saccharicida* Kirk. does not occur in Fiji. Should it ever reach there it would undoubtedly be held in check by the native enemies of the Fiji leafhopper *Perkinsiella vitiensis* Kirk. In fact our most effective leafhopper enemy *Cyrtorhinus mundulus* (Bredd.) was imported in quantity from Fiji in 1920. Our imported root grub *Anomala orientalis* (Waterh.) is not known to occur in the Philippine Islands. Should it ever reach there it would be immediately subject to attack by the parasitic wasp *Scolia manilae* Ashm., which is native to the Philippines and parasitic on native beetles related to *Anomala orientalis.* We have brought *S. manilae* from the Philippines and successfully used it against *Anomala orientalis* even though the latter was not its host there. These are simple cases; but they offer definite proof of our point.

A wise legislative policy, based on the belief that a rich native fauna presents an element of natural defense of large value, came to the speaker's attention during a sojourn on the Malay Peninsula in 1930. This region, one of the richest on the earth in fauna and flora, has from financial necessity but moderate protection through

quarantines against the importation of new pests. The geographical position of the Federated Malay States renders the maintenance of effective quarantines exceedingly difficult and costly. In considering the whole aspect of plant quarantine in 1930, the broad protection already operative through the presence of an enormously rich fauna was fully recognized. The realization of this natural asset in the control of immigrant pests plus the application of the limited funds available for quarantine service where most logically protective, has resulted in little or no waste in money and to date we have heard of no new insect visitation arriving to harass their crops. Such natural protection has never been Hawaii's lot and the entomologist will be required to stem the tide over and over again in the future as new pests arrive and new parasites and predators of these pests are required.

The maintenance of a local plant quarantine force will always remain of great importance to the welfare of the community. As stated above few if any countries offer so suitable a field for unrestrained development of imported insects as does Hawaii and consequently an efficient plant quarantine service is of prime importance to the Territory at all times. More men actually trained in entomology will be required on this force in the future. The excellent service rendered in the past, the improvement in the regulations pertaining to plant and soil importations and the coöperation offered by the steamship companies has done much to keep out or delay the arrival of new pests; but still they slip in in spite of the many precautions. The annual list of immigrant insects not hitherto recorded in Hawaii as prepared by Mr. Swezey each year, is impressive proof of what we may expect in the future. The next arrival of an insect with potentialities for destruction comparable to some of our spectacular immigrants of the past such as the Mediterranean fruit fly (*Ceratitis capitata* Wied.), the melon fly (*Bactrocera cucurbitae* [Coq.]), the sugar cane leaf hopper (*Perkinsiella saccharicida* Kirk.), the sugar cane beetle borer (*Rhabdocnemis obscura* [Boisd.]), the Anomala beetle (*Anomala orientalis* [Waterh.]), or the rose bettle (*Adoretus sinicus* Burm.), will probably be attended by a call for more entomologists on the quarantine staff in an effort to strengthen it and perhaps for more men suitable for parasitic work in foreign countries. Such a demand will be justified in view of the benefit already

derived from the introduction of foreign parasites of the above pests and the possibility of preventing the arrival of further pests through the development of a still more effective department of quarantine. There can be few countries that need plant quarantine protection more than the Hawaiian Islands. From the economic viewpoint it is the most important entomological work ahead of us.

The Pacific Entomological Survey, inaugurated some five years ago, has amassed invaluable data on the insects of the Marquesas Islands. The many manuscripts by world specialists on the various groups of insects collected by the Survey are in process of publication by the Bishop Museum, where the collections are deposited. Most of our insect problems have had their origin in the Pacific or in adjacent countries. Advance knowledge of the insect faunas of the Pacific Islands, where so much is yet to be discovered, forewarns and forearms us in the regulation of our quarantines and in the search for beneficial insects. The more we know of the insect faunas of the Pacific and their geographical distribution the less blind are our efforts in biological control work. The endeavors of the plant inspector can also be more intelligently directed. The Marquesan survey has been an excellent beginning. Many years more of work of this nature should follow until the other principal island groups of the Pacific have been at least roughly surveyed. The field is a rich one. Many entomologists of Hawaii in the future should have opportunity to penetrate some of these regions and make further contributions to the work so well started.

Owing to the specific nature of the work conducted by most of the entomologists in Hawaii today, little attention can be given to the many insect problems, large and small, that confront the average citizen in his household and garden. During the present year a record has been kept of the various requests for advice and help on matters outside the sphere of service for which the speaker and his fellow staff members are employed. Attention to most of these is time-consuming and generally insufficient to be entirely satisfactory. Such service can and often does interfere with one's regular duties. This is no doubt the experience of many entomologists whose entire time is taken up with special problems. Among the many requests for help on miscellaneous subjects the following may be listed:

Prenolepis longicornis Latr. This ant, which we commonly call the "crazy ant," occasionally occupies houses in such quantity as to cause great annoyance. Sweetened arsenic syrups have been found useful against it but considerable supervision is necessary in its preparation and applicaion.

Termites (*Coptotermes formosanus* Shiraki and *Cryptotermes piceatus* Snyder). We are frequently asked to examine buildings, furniture, etc., which are damaged, often beyond repair, by these two termites and, simultaneously, effective remedies are demanded. Much can be done towards alleviating the trouble and with the intelligent application of remedial measures results can often be entirely satisfactory. This can only follow after a careful study of each case. Much valuable service to the general public has already been rendered by several members of this Society on termite control; but the field is a large one and should ultimately fall within the realm of entomologists whose employment specifically includes termite control as a regular duty.

Cockroaches (*Diploptera dytiscoides* [Serville], *Periplaneta americana* [L.], *Blatella germanica* [L.] and others.) Some of the roaches which thrive indoors in Hawaii often cause much concern amongst local householders and complaints are not infrequent. A number of standardized methods of control have been found to have merit here but there is plenty of room for improvement. The so-called "beetle" roach *D. dytiscoides* notoriously disfigures our cypress trees by eating the bark from the young branches, often giving them a dead appearance over much of their leaf area. We have no satisfactory method of checking this damage as yet. Here is an entomological problem well deserving attention.

Silverfish (*Lepisma saccharina* Linné and probably one or two others). Book bindings, starched clothes, papers, etc., are often damaged by these insects. There is a considerable field for research in the development and practical application of traps, lures and poisons for use against such pests.

Cat Flea (*Ctenocephalus felis* [Bouché]). During May and June of the present year epidemics of this flea occurred in the houses and yards of several residents in Honolulu. This is not the first time we have observed such outbreaks. Usually an entomologist can remedy such a difficulty. The necessary procedure, based on his knowledge of flea habits, is comparatively simple, providing

it is thoroughly executed. But competent men are not always available to offer such help. We believe a time is approaching when more entomologists should be employed in the Territory whose duties will more closely relate to the many miscellaneous insect pests of the general community, such as fleas, roaches, silverfish, ants, etc.

Hibiscus White Fly (*Aleyrodes hibisci* Kotinsky). Hibiscus hedges are often seriously injured by this insect in Honolulu. Though not known outside Hawaii it is considered an immigrant. Should its original habitat ever come to light an excellent opportunity becomes open for a study and introduction to Hawaii of its natural enemies. Positive records of its host plants here are needed. We doubt if any attempts have been made towards control by artificial means. Very few aleyrodids have been recorded in Hawaii. The study and identification of our species, all of which are probably immigrant, will very possibly reveal several species not previously recorded here.

Carpenter Bee (*Xylocopa varipuncta* Patton). No parasites or other natural enemies have yet been imported to check this immigrant American bee though bees of this genus are known to have definite parasites in their native habitats. In view of the considerable damage caused through its borings in telephone poles, fence-posts and buildings, particularly where California redwood is used, a need for parasitic control is strongly indicated.

Control methods, parasitic or artificial, are yet to be found and are in demand for two other insects destructive to wood in Hawaii. We refer to the bostrichid beetle (*Sinoxylon conigerum* Gerst.) and the algaroba beetle (*Cyllene crinicornis* Chevr.). These have been credited during the year with injury to firewood of sufficient magnitude to result in an appeal for help. A fruitful subject deserving more attention for some local entomologist would be a study of insects associated with dead wood in Hawaii.

Fuller's Rose Beetle (*Pantomorus godmani* [Crotch]). This American insect disfigures many shrubs and other plants. We have no parasites for it in Hawaii and very little has been done respecting its biology here. It is quite probable that natural enemies will ultimately be found in Central America that will be useful against it if search is made for them.

Grasshoppers (*Atractomorpha ambigua* Bolivar and *Oxya chinensis* [Thun.]). Our two Acrididae are both foreign and do their fair share of damage to many ornamentals in gardens: the latter including rice and sugar cane in its miscellaneous fare. One egg parasite has been imported and established on the Oxya but is not sufficiently effective to date. A complex of several parasites or other natural enemies for both would fill a much felt want. No attempt has yet been made to check these grasshoppers by artificial means excepting by removal of their favored grass or weed hosts where other plants are cultivated.

The Rose Beetle (*Adoretus sinicus* Burm.). There are few property owners in Hawaii today who have not at some time had occasion to protest over the ragged, unsightly appearance of some coveted tree, shrub or other garden plants, their grape arbors or perhaps their vegetable gardens. A great deal of such damage, discontinuous in nature, can generally be ascribed to the adult *Adoretus sinicus*. Some parasitic control has already been accomplished; but much remains to be done before a satisfactory check is effected. No entomologist has yet given us a sufficiently detailed account of its life history and habits and the field of study in the use of repellants, attractants and poisons is still mostly an untouched one.

Green Coffee Scale (*Coccus viridis* [Green]). This scale often becomes literally plastered over all parts of certain plants, particularly coffee, citrus species and one of our best ornamentals (*Ixora macrothyrsa* Teijsmann and Binnendijk). Though some predacious and parasitic enemies, combined with an important fungus disease, at times play a large part in checking this coccid, the control is sporadic and the scale frequently gains sufficient headway to prove almost fatal to its favored host plants.

Another Coccid, the soft Black Scale (*Saissetia nigra* Nietn.), increases to destructive numbers on many plants in Hawaii. Here again parasites and predators, plus a fungus, operate with effectiveness at times; but not to the satisfaction of the layman, who is only aware of and concerned in the status of an insect pest during those periods when natural control factors are at a low ebb and the pest abundant. Soft scales are amenable to control by sprays. We have done little towards systematizing or standardizing spray formulae and schedules for application against our soft scales and

mealybugs that affect the many ornamentals and garden plants which thrive in these islands. Treatments effective on the mainland may need modification under our semitropical conditions. Here is plenty of opportunity for useful work by an ambitious entomologist. I doubt if any of us have attempted artificial control measures against some of our Diaspine scales also. Work on the Florida Red Scale, *Chrysomphalus aonidum* Linn., so common on palms, Cycads and citrus trees, would be a good beginning. The clear-cut results attending the artificial control measures perfected by Dr. Walter Carter against the pineapple mealybug *Pseudococcus brevipes* (Ckll.), strikingly suggest what may be accomplished in the insecticidal control of a fair number of coccids tolerated unnecessarily in most of our gardens.

The Coconut Leaf Roller (*Omiodes blackburni* [Butl.]) is another insect which attracts wide attention in Hawaii because of the unsightly appearance of most of our coconut palms resulting from heavy infestations by the larvae of this moth. Of late years many of the palms of Honolulu have been particularly free from this damage. This has evidently been caused by heavy parasitism amongst the eggs and larvae. A complete study of this notorious coconut pest with the object of clarifying our present understanding of the control factors would be a worthy undertaking. It is also possible that the foliage of young trees, conveniently reached by poison dusts or sprays may be protected after a proper investigation into the merits of such treatment has been made.

On the economic side there are still other problems in which the community will require the aid of the trained entomologist. The work of the Anti-mosquito League, so well begun a few years ago, has gone far in the suppression of mosquitos about Honolulu. It should and probably will continue to function. We are doing very little to help the local vegetable gardeners. Frequent and comprehensive surveys of the pests with which they are concerned will need to be made sooner or later, with the object both of determining what insects are present and what remedial measures can be applied. The recent arrival of the pepper weevil, *Anthonomus eugenii* Cano, in our Territory and the disastrous effect it has had upon the chili peppers in Honolulu gardens, offers an excellent problem for the future in a study of its natural

enemies in Mexico, with the object of their introduction to Hawaii if found.

The necessary support and confidence of the general public will always be difficult of attainment unless we give full attention and some definite relief to the many minor as well as major pests that come to their notice.

There is much yet to be done with our native Hawaiian insects, especially with respect to their biologies and hosts. We learn from those best informed on the endemic insects of Hawaii that a great deal is still unknown concerning parasites of our insect fauna. A study of all the insects associated with any given host plant or special environment results in much that is new, as evidenced by the many interesting published records occurring in our "Proceedings." Most of us visit our mountains but rarely; some perhaps feeling that our scanty indigenous fauna leaves little still unrecorded. We have abundant proof to the contrary from the unfailing reports, month by month, that are given by the few enthusiasts of our Society who periodically brave our trails to return with something new.

We must never shelve into the background the importance of systematic work. The correct identity of every insect in the Territory is of the greatest importance. It is hardly necessary to state that each and every achievement in the biological control of insect pests here has been accomplished only after the systematist has first correctly established the identity of the insect in question.

From our viewpoint the Bishop Museum is becoming increasingly important as the logical repository for our Pacific Island and Hawaiian insect collections. Substantial additions have been made through the recent work of the Pacific Entomological Survey and without question much more material will be added from time to time, either by organized surveys or through contributions made by individual members of this Society. A year seldom if ever passes without one or more of this group visiting some of the other Pacific Islands either for business or pleasure and returning to further enrich our collections and knowledge of Pacific insect faunas. In view of the magnitude and economic importance of these growing collections and the unending work involved in their proper ordering and maintenance, a full time curator of insects at

the Bishop Museum, with few, if any, other duties, is badly needed. It will be gratifying to those in Hawaii who appreciate the importance of entomology in the Pacific when such an appointment is made.

Our Society is to be congratulated on the attendance at the monthly meetings throughout the year and on the many interesting and valuable contributions presented for publication in our Proceedings. It is sincerely hoped and believed that we will continue to grow and prosper and keep up the high standard of work which has so characterized the patient endeavors of our members for the past 29 years.

Fire Ants in Dry Areas

BY J. S. PHILLIPS

(Presented at the meeting of January 5, 1933.)

There are marked differences in *Solenopsis geminata* Fab. *rufa* Jerdon behavior according to habitat.

Whereas in pineapple fields, this ant lives in very large colonies, its nests extend to a considerable depth and the individuals are very pugnacious and intolerant of other insects; in dry areas they have small colonies, shallow nests and are comparatively peaceful.

Some of the workers of very small communities are much smaller than the normal minor worker; it is possible that these are the first brood of a new colony and have been fed by the queen with her saliva. These minute individuals are not found in pineapple fields.

Fire ants store a variety of seeds in their nests: wood sorrel, crab-grass, purslane, wire-grass, foxtail, spurge, sow thistle and fuzzy rattlepod being among those preferred.

In very dry areas, a black-and-white silverfish is found in association with Solenopsis; it is a very rapid mover. What its relations are with the fire ant, I do not know.

In moister areas, especially in cultivated ones, fire ants are being driven out by *Pheidole megacephala* (Fab.), though in certain circumstances, there are temporary reverse fluctuations; but in dry areas the latter cannot advance, for Solenopsis can stand both higher temperatures and lower humidities than its competitor and if the two species are placed under exactly similar conditions either of high temperature or of low humidity, or both, Solenopsis will flourish whereas all castes of Pheidole will succumb in a very short time. Laboratory experiments support this view as well as field conditions.

The Immunity of Pseudococcus brevipes (Ckll.) to Parasitism by Coccophagus gurneyi Compere*

BY CARL T. SCHMIDT

(Presented at the meeting of February 2, 1933.)

In October, 1931, the question arose as to whether the pineapple mealybug, *Pseudococcus brevipes* (Ckll.) could be parasitized by *Coccophagus gurneyi* Compere. This parasite is normally found attacking the Citrophilus mealybug, *Pseudococcus gahani* Green, in California. Permission was obtained from the California State Department of Agriculture to bring living specimens of the pineapple mealybug, obtained from pineapples in ship stores at San Pedro, to the quarantine rooms of the Citrus Experiment Station at Riverside, California, to make trials to determine whether Coccophagus would oviposit in the pineapple mealybug and whether the parasite would develop in them.

Trials consisted of putting several females in test tubes, each of which contained a single mature mealybug. As soon as the parasites were aware of the presence of the mealybugs they began to oviposit in them with such ardor that it was necessary to push them away with a small brush to prevent super-parasitism. Two days later one of these mealybugs was dissected and a single parasite egg was found in which it was possible to distinguish a developing embryo. The following day two more mealybugs were dissected. In these one could see small black spots through the derm of the host. These spots proved to be pellets remaining after the parasite eggs had been destroyed either by a phagocytic action of the host cells or by some reaction of the body fluids of the host. Examination of mealybugs at a later date failed to reveal even the black pellets. These observations showed definitely that the pineapple mealybug was immune to parasitism by *Coccophagus gurneyi*. Due to lack of host material it was impossible to determine whether the parasite could develop when a large number of eggs were laid in the mealybug.

* Published with the approval of the Director as Technical Paper No 41 of the Experiment Station of the Pineapple Producers' Coöperative Association, University of Hawaii.

The observations of Compere and Smith have indicated that *Pseudococcus citri* (Risso) also exhibits a similar immunity to parasitism by *Coccophagus gurneyi.* The writer wishes to acknowledge the assistance of Mr. Harold Compere for his help in making these trials.

LITERATURE CITED

Compere, H., and H. S. Smith. The control of the Citrophilus mealybug *Pseudococcus gahani* by Australian parasites. Hilgardia 6:585-618 (1932), pp. 600-601.

Description of a New Species of Thysanura (Campodeidae) from the Hawaiian Islands

BY DR. F. SILVESTRI, PORTICI, ITALY

(Presented by Mr. Van Zwaluwenburg at the meeting of May 4, 1933.)

Among some small Arthropods, received for determination by Mr. Van Zwaluwenburg of the Hawaiian Sugar Planters' Association Experiment Station, I have found some specimens of the Thysanuran Campodeidae, which I describe as a new species of a new subgenus ascribed to *Plusiocampa* Silv. and I take pleasure in naming it after Dr. R. C. L. Perkins, the first greater student of the Hawaiian Insects.

I remember that this is the second species of *Campodeidae* known until today from the Hawaiian Islands, the other being *Lepidocampa giffardii* Silv.,* which I collected near Hilo.

Family CAMPODEIDAE

Genus PLUSIOCAMPA Silv.

Subgenus Microcampa nov.

This subgenus differs from subgenus Litocampa Silv. for the shortest posterior macrochaetae of meso- and metanotum; for the legs destitute of macrochaeta on the dorsal part of femur; for tergites of abdomen lacking of macrochaetae from the first to the seventh.

Typus: the species here described.

Plusiocampa (Microcampa) perkinsi sp. n. (Figs. I-II).

♀ : Corpus albicans setis dorsualibus minoribus brevissimis mesonoti μ 12 longis, simplicibus, macrochaetis vix vel parum barbatis.

Caput supra setis brevissimis parum numerosis, setis frontalibus anticis medianis aliquantum longioribus vix barbatis, setis occipitalibus vix barbatis; antennae 16-articulatae, articulis primo et secundo setis paucioribus brevioribus partim vix barbatis, articulo tertio setis brevioribus et brevibus paucis

* Boll. Lab. di Zool., Portici, vol. 25, pp. 282-285, figs. 4 and 5, 1931.

integris vel subintegris, trichobotriis consuetis, sensillo apicali externo minimo cylindraceo, macrochaetis brevibus (supera externa mm. 0.04 longa), articulis ceteris, decimo exempli gratia, aliquantum latioribus quam longioribus setis nonnullis brevibus integris vel, proximalibus, apice bifurcato instructis.

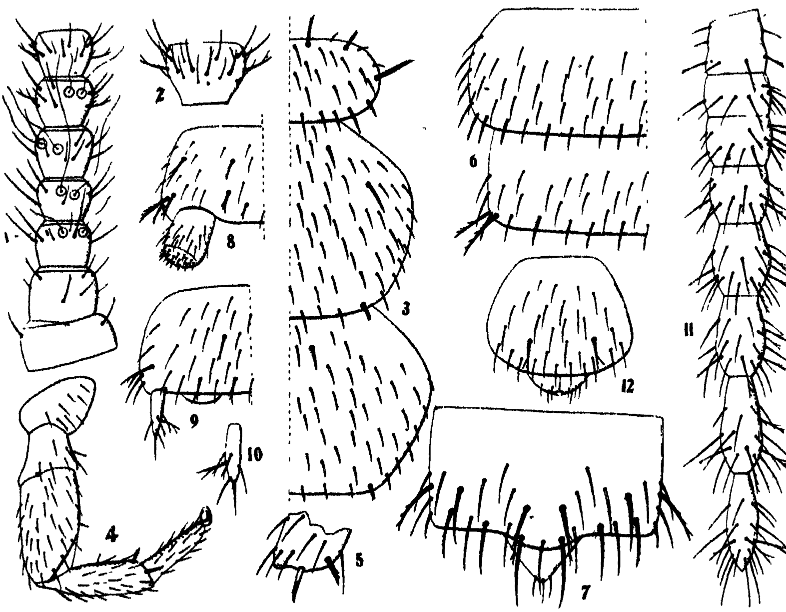


FIGURE I

Plusiocampa (Microcampa) perkinsi: 1. antennae laevae pars proximalis; 2. eiusdem articulus decimus magis ampliatus; 3. thoracis dimidia pars prona; 4. pes paris tertii; 5. eiusdem tibiae apex magis ampliatus; 6. urotergitorum septimi et octavi dimidia pars; 7. urotergitum decimum cum valvula supranali; 8. urosterni primi dimidia pars; 9. urosterni quinti dimidia pars; 10. eiusdem stilus magis ampliatus; 11. cercus dexter pronus; 12. urosternum octavum.

Thorax: Pronotum macrochaetis $3 + 3$, quarum submediana brevior est et apice barbulis 1-2 minimis aucta, sublateralis intermedia quam submediana paullum brevior et lateralis quam submediana parum longior, setis marginalibus posticis quam superficiei paullum longioribus et paullum crassioribus; mesonotum macrochaetis $3 + 3$, quarum subantica submediana et postica lateralis breviores sunt, subantica sublateralis quam ceterae parum longior; metanotum macrochaetis $2 + 2$ (subantica submediana et postica laterali) brevioribus, cetero mesonoto et pronoto simili.

Pedes femore macrochaetis infera distali et marginali antica brevioribus

ramulo minimo auctis, tibia macrochaeta ventrali breviore apice bifurcato, calcaribus sat robustis barbulis 2-3 auctis, tarso setis ventralibus simplicibus, praetarsi unguibus sat arcuatis, supra latiusculis, subtus mediis carinatis, seta proximali externa attenuata, unguium longitudinem attingente.

Abdomen: Tergita 1-7 macrochaetis nullis, setis marginalibus posticis quam superficiei paullum crassioribus et una vel duabus lateralibus barbula vix vel male distincta auctis; tergita octavum et nonum macrochaetis posticis lateralibus supera et infera brevibus (mm. 0.04 longis) barbatis instructa; tergitum decimum macrochaetis subposticis breviter barbatis parum robustis 3 + 3 inter sese subaequalibus et posticis 4 + 4 gradatim a submedianis brevioribus.

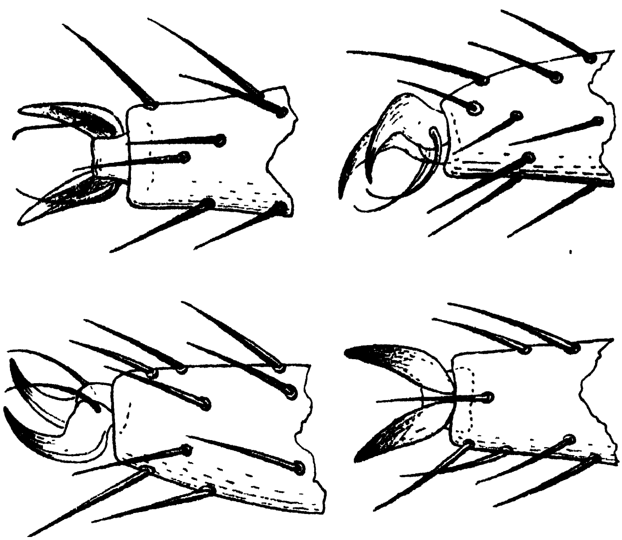


FIGURE II

Pedis tertii paris tarsi apex et praetarsus antice, supra, subtus et postice inspecti.

Urosternum primum macrochaetis 7 + 7, quarum laterales subantica et subpostica breves quam ceterae aliquantum longiores barbatae, submedianae breviores barbulis 1-2 brevissimis auctae, appendicibus lateralibus cylindraceis quam sternum aliquantum brevioribus; urosterna 2-7 macrochaetis 4 + 4, stilis brevioribus seta submediana infera bifurcata, setis duabus praemedianis apice bifurcato, seta subapicali integra, seta apicali processu basali proximali minimo tantum aucta; urosternum octavum macrochaetis submedianis subposticis 1 + 1 apice bifurcato et ramo interno ramulo minimo aucto.

Cerci breviores 8-articulati, articulis a secundo gradatim usque ad penultimum parum longioribus et usque ad ultimum angustioribus, omnibus

setis nonnullis brevioribus integris et brevibus barbulis 1-4 auctis (articuli tertii seta supera externa mm. 0.04 longa).

Mas ignotus.

Long. corporis ad mm. 1.80, long. antennarum 0.58, pedum paris tertii 0.32, cercorum 0.48.

Habitat. Oahu: Honolulu (Nos. 61, 62, 63).*

* These numbers refer to sugar cane soil samples taken in 1925 as follows: 61 and 62, Keeaumoku St. plots, Honolulu; 63, Alexander St. plots, Honolulu. All samples were to a depth of 9 inches (Van Zwaluwenburg).

New Species of Hawaiian Lepidoptera

BY O. H. SWEZEY

(Presented at the meeting of December 7, 1933)

The holotypes of the species here described are in the collection of the Hawaiian Entomological Society; paratypes, where available, in the Bishop Museum.

PYRAUSTIDAE

Promylaea quadrifascia n. sp.

Male. Expanse 14-17 mm. Head and thorax brownish fuscous, palpi and antennae concolorous; frons below antennae, and dorsum of thorax, shining bluish-leaden. Forewings brownish fuscous, with four wide, transverse orange bands, each preceded by a shining bluish-leaden band; the second orange band has an outward projection at middle; the orange and leaden bands occupy nearly all the wing. Cilia brownish fuscous, darker at base. Hindwings and cilia brownish fuscous; disk of wing lighter in color; cilia darker at base. Abdomen and legs brownish fuscous; all tarsi and hind tibiae pale.

Hab.—Alakai Swamp, Kauai, about 4000 feet elevation. Holotype male captured August 22, 1921; five paratypes, males, captured July 14, 1932. All taken by sweeping on the stunted lehua and other shrubs at the first open bog on the trail to the Kilohana lookout into Wainiha Valley, by O. H. Swezey. The paratypes are very much abraded, but may readily be determined by the characteristic orange bands on the forewings.

The only other known species of the genus Promylaea is *pyropa,* described from a single female taken in the mountains of Molokai. It is a very dark species, nearly entirely black. It has been collected on Mt. Tantalus, Hering Valley, Woodlawn Tract in Manoa Valley, and Halawa Valley on Oahu; and on the Upper Hamakua Ditch trail in Kohala Mts., Hawaii. The larvae of this species are leaf-miners in the leaves of *Peperomia pachyphylla* and possibly other species of the genus Peperomia. It would be interesting to discover the larval habits of the present species, which will doubtless be found to feed on Peperomia also.

Proc. Haw. Ent. Soc., VIII, No. 3, July, 1934.

CYGNODIIDAE

Petrochroa elegantula n. sp.

Male and female. Expanse 6 mm. Antennae black, spotted with white in front on the basal two-thirds. Palpi dark fuscous and white mixed. Head and thorax greyish fuscous, posterior margin of thorax whitish. Forewings dark fuscous, greyish fuscous at base and nearly black on apical third; an irregular transverse white bar at one-fourth; a silvery white transverse bar at one-half, followed by a large irregular orange patch extending nearly across the wing and narrowed towards dorsum; beyond this about a half dozen small spots of silvery-white scales, varying in size and arranged differently in different specimens; cilia greyish, black at base. Hindwings and cilia pale greyish fuscous. Abdomen greyish fuscous, a few white scales at apex, underside white. Legs black, spotted with white, hind femora white beneath.

Closely related to *Petrochroa neckerensis* Swezey (Bernice P. Bishop Museum, Bull. 31, p. 78, 1926), but the transverse white bars on forewings are differently placed.

Hab.—Oahu: 1 specimen, Koko Crater, Feb. 2, 1919; 2 specimens, Makapuu, Jan. 25, 1920, and March 13, 1921; 1 specimen, Barbers Point, Dec. 23, 1923; 12 specimens, Koko Head, Jan. 20, 1924; 1 specimen, Waimanalo, Feb. 7, 1926. All collected by O. H. Swezey on flowers of *Lipochaeta integrifolia.* Only adults have been collected so far. The larval habits have not been discovered.

GRACILARIADAE

Philodoria costalis n. sp.

Male and female. Expanse 7-8 mm. Antennae uniformly light brown, about ¼ longer than wing. Palpi white shaded with brownish externally on apical part of median joint and the most of the terminal joint. Head, thorax and abdomen tawny brown, whitish beneath and the lower part of face whitish. Forewings tawny brown, apical half suffused with orange; a narrow white line on costa from base to about 2/3, where a white bar extends obliquely outward nearly half across the wing, this line bordered with fuscous scales; an opposite pair of white spots at about ¼ from apex, between them a shining pale blue patch; at apex another patch of blue scales which extends into apical cilia, preceded by a few fuscous scales; two small white spots in costal cilia near apex, rest of apical and the terminal cilia brown; a broadly oval to nearly circular white spot about middle or just beyond middle of fold, not reaching dorsum. Hindwings and cilia brownish fuscous. Legs light brown, whitish beneath.

This species is very close to *micropetala* which was described from Halemanu, Kauai. It differs from that species in having

the white costal line, and lacking the fuscous scales along middle of apical orange area.

Hab.—Oahu: Makaha ridge about 3000 feet elevation, west side of Mount Kaala, Waianae Mountains, April 15, 1934 (Swezey). A Pipturus tree was found having numerous mines in the leaves. From leaves collected, larvae issued and formed oval brown cocoons on the surface of the leaves, from which 6 adults issued later. This is the seventh lepidopterous leafminer on Pipturus in Hawaii.

The Distribution of the Genus Rhyncogonus on Oahu (Col. Curculionidae)

BY O. H. SWEZEY

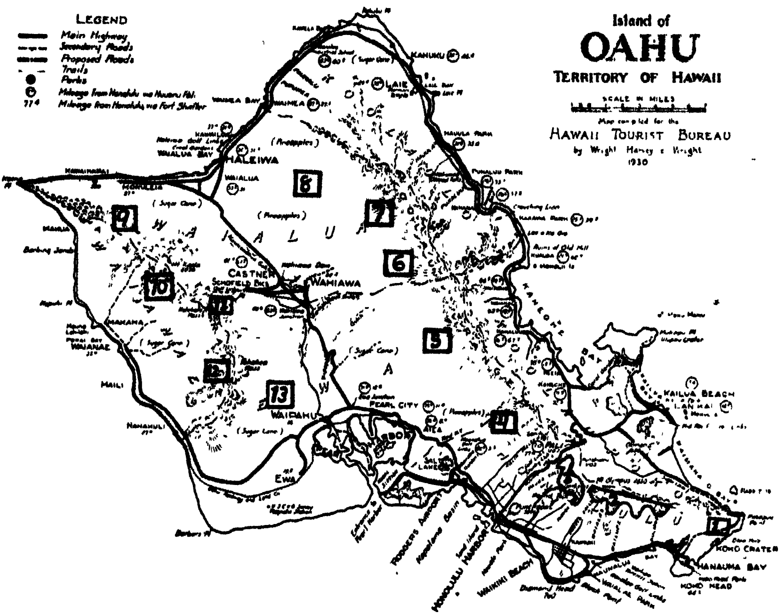
(Presented at the meeting of April 6, 1933)

The genus Rhyncogonus was erected by Dr. David Sharp in 1885 for *blackburni,* the largest black species on Oahu. At the same time *vestitus* was described from Maui. Since then there have been 10 species described from Oahu and one undescribed;* 10 species from Kauai; 4 species from Molokai; 1 species from Maui; 2 species from Lanai; 1 species from Hawaii; and one each from Laysan, Nihoa, Necker and Wake. A total of 34 species is thus known to occur on the islands of the Hawaiian group. Up to the present only one species is known to occur on more than one island: *simplex* of Molokai has been collected of recent years at Koko Head on Oahu.

These beetles are flightless and the 13 species known to occur on Oahu, each is quite limited in its distribution. Some of them are rare, and have been collected only on the one occasion. Just why they should be rare is not understood. No natural enemies are known for them, except that an egg-parasite (*Eupelmus rhyncogoni* Perkins) has been reared from the eggs of *blackburni* on Mt. Tantalus, and Dr. Perkins found Rhyncogonus beetles in the stomach of the native thrush (*Phaeornis palmeri*) on Kauai. Dr. Perkins says, "*Phaeornis palmeri* is a most successful hunter of Rhyncogonus, for in all cases these beetles were found in the bird's stomach, even to the exclusion of all other food, while they have been found in no other bird." (Fauna Hawaiiensis, Introduction, p. CXX, 1913.)

The distribution of the species on Oahu is shown by the accompanying map.

* *Rhyncogonus welchii* Perkins. Proc. Haw. Ent. Soc., VIII, No. 2, p. 269, 1933. [Ed.]



Colonies of Rhyncogonus on Oahu. Localities are indicated by the numbers in the squares. The species do not overlap. They are mostly between 1,000 to 2,000 ft. elevation.

No. 1,	*Rhyncogonus*	*simplex* Perkins.	Near Mokapu and at Koko Head.
" 2,	"	*koebelei* "	Palolo to Kuliouou.
" 3,	"	*blackburni* Sharp	Manoa, Mt. Tantalus and Pauoa.
" 4,	"	*mutatus* Perkins	Moanalua.
" 5,	"	*obsoletus* "	Waimano.
" 6,	"	*segnis* "	Wahiawa.
" 7,	"	*freycinetiae* "	Helemano.
" 8,	"	*oleae* "	Waialua.
" 9,	"	*fuscus* "	Mokuleia.
" 10,	"	*funereus* "	Waianae.
" 11,	"	*saltus* "	Kolekole Pass and Puu Hapapa.
" 12,	"	*welchii* "	Halona Valley.
" 13,	"	*extraneus* "	Kunia, about 400 ft. elevation, in cane fields.

Harroweria gloriosa Hebard, a Katydid Stowaway from Panama (Orthoptera: Tettigoniidae)

BY O. H. SWEZEY

(Presented at the meeting of December 7, 1933)

On March 20, 1933, three very peculiar young grasshopper-like insects were found by Dr. H. L. Lyon in his orchid greenhouse in Honolulu, where they had evidently recently hatched from eggs, which, under the circumstances, undoubtedly must have been in or associated with some one of the numerous orchids. Search near where these young insects were found revealed a leaf on a plant of *Oncidium stipitatum* containing obscure punctures from which evidently these insects had hatched. There were about a dozen of the punctures, placed about an inch apart in the elongate fleshy leaf, and each puncture apparently contained two eggs. This leaf was cut off and placed in an appropriate container in the quarantine room of the Experiment Station, H.S.P.A., to observe further hatching, if any.

The young nymphs were also retained in the same quarantine room for experiments on feeding habits, and possible rearing to maturity for determining the identity of the strange insects, as they were different from anything known to the entomologists. After trying them with orchid flowers and several other things, it was found that they ate canna flowers very readily, and so these were used for their sustenance till they reached maturity. Among the flowers which they ate readily were: canna, hibiscus, hollyhock, dahlia and *Datura arborea*. They did not eat orchid flowers, nor the leaves of canna, sugar cane or "ti" (*Cordyline terminalis*).

From the orchid leaf containing the eggs hatching took place as follows:

March 20, 3 hatched		April 3, 5 hatched	
" 23, 1 "		" 4, 1 "	
" 24, 1 "		" 5, 2 "	
" 25, 3 "		" 7, 1 "	
" 26, 6 "		" 13, 1 "	
" 28, 1 "		Total 28	
" 29, 1 "			
" 31, 2 "			

The times of molting were not accurately kept; but the first molt occurred April 3; 2nd molt not recorded; 3rd molt April 24; 4th molt April 29; 5th molt May 9; 6th molt not recorded; 7th molt (adult) May 26. This would indicate that it took about two months to mature from the time of hatching. But there is no certainty that the first to mature were the ones that hatched first, for an occasional nymph died, and others of the several instars were killed for preservation. At the 5th molt, 4 nymphs showed ovipositors for the first time. Fourteen were carried through to maturity, maturing on the following dates:

May 26, 3 males
May 27, 2 males
May 30, 2 males
June 2, 2 males; 2 females
June 3, 1 male
June 6, 1 female
July 2, 1 female

10 males; 4 females

Adult specimens were submitted to Mr. Morgan Hebard* at the Academy of Natural Sciences, Philadelphia, Pennsylvania, who recognized the species as *Harroweria gloriosa,* which was described by him in 1927 (Trans. Amer. Ent. Soc., 53, p. 89, pl. 18, fig. 2) from a single female specimen collected at Gatun, Canal Zone, Panama, Aug., 1916, by Mr. D. C. Harrower, "flying in the dark recesses of a heavy forest." This is the first record of it since, and the first that is known of its habits.

Tracing the history of the orchid plant which contained the eggs of this katydid, it was shipped from Panama, Sept. 9, 1932. The eggs must have been deposited in the orchid leaf before that date; hence, about 7 months must have intervened between oviposition and hatching. There apparently was no connection of the insect with the orchid plant except as a convenient place for inserting its eggs. It need not be classed as an orchid insect unless further evidence is obtained in the future.

* From specimens sent from Honolulu, Mr. Hebard has now described the male, pointing out the distinctions between the sexes particularly in the coloration of tegmen and wings. (Entomological News, XLV, pp. 13-14, 1934).

This occurrence indicates the possibilities of insects smuggling their way into new regions in imported orchid plants, and shows the necessity of precautions when such importations are made. Furthermore, since the above orchid was vacuum-fumigated with hydrocyanic gas on arrival in Honolulu, this incident demonstrates the uncertainty of such fumigation as a safeguard against undesirable insects gaining admission in imported plants. If the above orchid had been planted in the open instead of being retained in a carefully watched greenhouse, these young katydids might have hatched and escaped being noticed, with the likelihood that they might have become established in Honolulu, and thus been another addition to our list of recent immigrant insects,** and in such an instance it would never have been known how this insect gained entrance.

This katydid might not have been of particular importance even if established, but the fact that the nymphs were reared to maturity on canna flowers and that they ate other flowers also classes it as an undesirable insect in spite of its colorful attractions. We have already two species of katydids with flower-eating habits: *Elimaca punctifera* (Walker) and *Holochlora japonica* (Brunner), which cause considerable annoyance in flower gardens.

** In each issue of the Proceedings of the Hawaiian Entomological Society is printed a list of the immigrant insects first appearing or being first recorded that year.

Insects from Bermuda Grass, Kawela Bay, Oahu, April 23, 1933

BY O. H. SWEZEY

(Presented at the meeting of May 4, 1933)

ORTHOPTERA

Oxya chinensis (Timb.).—Nymphs were common.
Conocephalus saltator (Sauss.) Adults and nymphs common.

LEPIDOPTERA

Spodoptera mauritia (Boisd.).—Small and half grown caterpillars common, but not numerous enough to produce noticeable eating of the grass.

One caterpillar bore a cluster of larvae of *Euplectrus platyhypenae* Ashm. which later matured. Another caterpillar had a cluster of Euplectrus eggs, but it died and two larvae of *Frontina archippivora* Will. issued. Some of the caterpillars had the appearance of being parasitized by *Hyposoter exiguae* (Vier.) and an occasional cocoon of this parasite was seen.

DIPTERA

1 *Toxomerus marginatus* (Say).—A plump female of this syrphid fly was obtained. It is the second record of its occurrence on Oahu.

HEMIPTERA

3 *Oronomiris hawaiiensis* Kirk.—A grass-feeding bug.
5 *Reduviolus capsiformis* (Germ.).—Predacious on other smaller insects.
1 *Stictocephala festina* (Say).
4 *Phrynomorphus hospes* Kirk.—A grass-inhabiting cicadellid. Five small nymphs were obtained which were parasitized by dryinid larvae. No adult dryinids secured.
10 *Bythoscopus robustus* (Uhler).*—2 from *Scaevola frutescens*. No nymphs. were found. The first record for the Hawaiian Islands.
Antonina indica Green.—Abundant. 8 females of its parasite, *Anagyrus antoninae* Timb., were obtained, as well as a few males.
Pseudococcus insularis Ehrhorn.—This mealybug must have been present, for 18 females of its parasite, *Anagyrus swezeyi* Timb., were obtained, and also some males.
Odonaspis ruthae Kotinsky.—Probably this scale was present, for 7 of its parasite, *Adelencyrtus odonaspidis* Full., were obtained.

* Identified by Mr. E. P. Van Duzee. Proc. Haw. Ent. Soc., VIII, No. 3, p. 381, 1934. [Ed.]

Coleoptera

1 adult scolytid and several larvae found in stems of the grass. These were found by examining an occasioal freshly dead stem, and finding the tiny hole where the adult beetle had bored in, and the larvae were found inside.

1 *Scymnus notescens* (Blkb.).—Probably accidentally there, as it is an aphis-feeding ladybeetle.

1 *Bruchus amicus* Horn.—Probably just hiding—must have bred from pods of *Acacia farnesiana* as there were plants present.

Hymenoptera

Besides the parasites mentioned above, also the following:

1 *Pauridia peregrina* Timb.

4 Eulophids or elachistids.—Possibly new—yellow and green.

Pheidole megacephala (Fab.).—Numerous.

Cardiocondyla wroughtonii hawaiiensis Forel.—Common.

Notes on the Habits and Life History of *Sciara molokaiensis* Grimshaw, a Serious Pest of the Roots of Plants in Hawaii (Mycetophylidae).

BY J. F. ILLINGWORTH

(Presented at the meeting of December 7, 1933)

For several years I have been making notes on the habits of these troublesome little flies. They are commonly called Fungus Gnats, because of their well-known habit of breeding in mushrooms. It is their relation to the higher plants, however, that has brought them forcibly to my attention. The larvae live in the soil and under certain weather conditions are very destructive to living roots.

In April, 1926, while growing pineapple plants in root cages in our greenhouses at the University, I discovered that root tips were being eaten out by the larvae of these flies. Further search showed that this pest occurred throughout the pineapple-growing sections. It was easy to see the damage that the larvae do to newly-set plants. By pulling up plants that have failed, it is not uncommon to find clusters of the "worms" congregated on the end of the cut surface. In that position they are ready to devour the ends of the new roots as fast as they push out. Rots then cause the death of the whole plant.

Looking up the literature on the subject, I found that these insects have been recorded attacking the roots of wheat, corn, clover, alfalfa, grasses, cucumber, lettuce, carnations and plants in greenhouses. They also injure potatoes, causing a scabby appearance, breed in tulip bulbs, and even are recorded as infesting such fruits as the apple.

Hence it is not surprising to find these flies attracted by the tissues of pineapple plants. Undoubtedly they do far greater injury than any of us heretofore have suspected. Naturally it is very easy to overlook such tiny creatures, especially under field conditions. Yet it is not difficult to see the gnat-like flies, especially on a quiet sunny morning as they swarm about the

plants. Then, following this up by observations on what is taking place underground, using the root cages, we see the devastation caused by the maggots.

Mycetophylid flies, magnified about 10 times. The small figure at the left, in the circle, is about natural size. In this state the insects are seen hovering about the plants and entering the soil to lay their eggs.

HABITS AND LIFE HISTORY

The best papers treating on these subjects deal with species affecting house plants * and mushrooms.** In the latter paper the female fly is said to be able to produce 1000 eggs. These require only three days to hatch, the larvae feed for seven days and pupate, the adult flies emerge four days later. Thus it will be observed that under mushroom house conditions the whole life period from egg to egg again is only fourteen days. I have

* Journ. Econ. Ent. vol. 9, pp. 538-49.

** U. S. Dept. Agric., Farmers' Bull. No. 789.

estimated, rather roughly, the time required here to be about twenty-four to thirty days.

In one instance I found a fly in the root cage had gone down into the soil a depth of six inches, depositing her eggs against the glass, where they were all in plain view. These were arranged in five bunches, placed in a sort of circle, about one inch in diameter. The dead body of the mother fly was in the center.

Larvae of mycetophylid flies, magnified about 12 diameters. The small black line below is about their natural size when full grown. These maggots are found in any plant refuse when it is decomposing. In the soil they feed on the root hairs and root tips causing the destruction of living plants.

Each of the bunches had approximately twenty eggs, so evidently this female had died when she finished laying about one hundred eggs—possibly she had deposited others elsewhere. The individual eggs were oval in appearance and yellowish in color; the clusters being quite easily visible to the naked eye.

After six days the larvae hatched and made their first meal on the eggshells. They then began to devour the body of their mother. The following day they had increased wonderfully in

size and had moved in a mass to young roots about three inches away. Every root tip was eaten out and the larvae were browsing on the root hairs. Feeding for a period of twelve days on all the roots within a radius of about six inches, the larvae appeared to be fully grown. They began their movement toward the surface, forming a continuous line single file. I watched them spinning flimsy silken walls to hold the particles of soil in the cavities where they pupated. Six days later the flies emerged. Hence the whole life cycle was accomplished in twenty-four days.

During emergence under normal conditions, the pupae work their way to the surface of the soil. It is interesting to see the flies emerge. I watched one come out of its pupal skin: At first it slid out very slowly, and I thought I would see the process of expanding the wings, which is a common procedure among flies. To my surprise, however, he ran away so fast that I lost my sight of him entirely. He shot out of the empty pupa skin like a young pheasant just out of the egg. I have never seen any other creature to equal it for precociousness.

As indicated above, the larvae of these flies are omnivorous feeders. I have found that the flies congregate around piles of semi-decomposed manure. The maggots occur in this material in writhing masses all clustered together. Again, we usually find them abundantly in old pineapple stumps in our fields, and they even show a great preference for the decomposing fruits. In field practice these waste products are commonly pushed out of sight under the plants. Here the pests breed in such countless numbers that they become a real menace to the growing plants. During periods of drought, especially, the larvae attack the living roots.

More recently, I have experienced considerable difficulty from these flies attacking the roots of other greenhouse plants. Maidenhair ferns were badly injured. Seedlings of some flowering plants are often almost a complete failure because of the ravages of the maggots. This, I find, is particularly true with pansies grown in "flats." Usually the seeds germinate and give promise of a fine stand; then, in a few days, all the plants wither and die. Digging in the soil discloses the myriads of Sciara maggots. The adult flies are usually also much in evidence, hovering around the boxes.

CONTROL MEASURES

Possibly we can make use of what we know of the feeding habits of the larvae of these flies. And again their relation to soil moisture is also an important consideration.

I tried placing rotting stable manure on the surface of the soil in one root cage. The flies from all over the greenhouse came to that cage. Soon the manure was full of maggots, yet none of them attacked the roots. The larvae were evidently quite satisfied with the manure, as long as it was kept moist. On the other hand, when I tried drought conditions, reducing the moisture so that the soil became quite dry, the maggots left the manure and became destructive to the roots.

Unfortunately we are unable to control the moisture supply in our pineapple fields. We grow a heavy stand of grass, or leave the refuse from the pineapples in the soil, all breeding and accumulating these pests. When, perchance, dry weather comes on, the damage is done. In the natural course of growth, these creatures must have their supply of moisture to survive. They turn to living roots as the only available supply of water, and the plants are required to meet a double drain—both drought and loss of roots.

The above observations suggest a cure. Could we not bait the pest? We may be able to treat the decomposing substances with poison, if we can find a chemical that does not act as too much of a deterrent to the feeding larvae. Another consideration, too, is the effect of this poison upon other decomposing organisms, such as fungi, bacteria, etc.

Again, as I have suggested, burning the plant refuse during drought conditions, gives the pests a serious setback. Piles of old stumps and refuse when filled with the larvae may be burned with advantage. It should be noted, however, that firing would be of little avail after the material has become dry. In that case all the creatures have left it and gone into the soil.

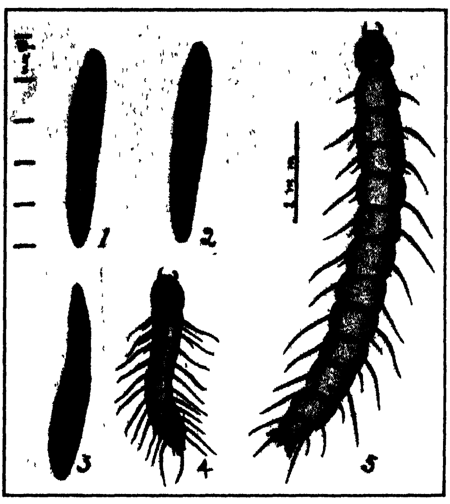
Finally, my experiments in the laboratory showed that the maggots are very susceptible to either of the extremes of moisture. Too much water kills them as quickly as too little. This fact could be made use of where flooding is practical. I used this method successfully in the greenhouse, and found that by adding an extract of pyrethrum the flies avoided the treated soil.

Life History and Habits of *Apelma brevis* Johannsen (Chironomidae)

BY J. F. ILLINGWORTH

(Presented at the Meeting of December 7, 1933)

Investigating pests of pineapples, I discovered the larvae of these tiny midges usually present in water which collects in the axils of the central leaves. Apparently these larvae feed upon wind-borne, decomposing organic matter that naturally washes down into their retreat. I should note, however, that the mouth of the larva is provided with a pair of needle-like hooks, which it uses in pulling itself forward. These hooks are capable of puncturing the tender white tissue at the base of the leaves, and possibly



Camera lucida drawings of the early stages in the life history of the pineapple midge, *Apelma brevis* Johannsen. 1, the egg, about half a millimeter in length; 2, the hatching larva, inside the egg; 3, the empty shell; and 4, the newly hatched larva. These are all drawn on the same scale; 5, the full-grown larva, dorsal view, about 4 millimeters in length. Note particularly the needle-like jaws which the larva uses to pull itself along when moving about on the surface of the leaf.

they do this in the ordinary movements of the maggot. But there are no visible abrasions of the epidermis, and we have no conclusive evidence that they cause infections.

I was unable to determine the species, so specimens were sent to Dr. J. M. Aldrich, of the U. S. National Museum, August 12, 1927. Dr. Aldrich finally sent the specimens on to Prof. O. A. Johannsen of Cornell University, who replied:

Photograph of side view of the head of full-grown larva (greatly magnified) to show the claw-like jaws, though they are partly retracted. The single front foot, with its fringed margin, is also well shown here.

" . . . . This is a new species of Apelma, the members of which, so far as known, live in the axils of leaves of tropical plants. There are two European species whose habits are unknown . . . ."

October 28, 1927, Dr. Aldrich wrote:

"Professor Johannsen has drawn up a paper describing your little Chironomid injuring pineapples, as *Apelma brevis* new species. He has returned three of the five specimens to the National Museum, one being the holotype. . . . " This description was published (Ent. Soc. Wash. vol. 29, p. 205, 1927). I made a brief note of it in our own Proceedings, vol. vii, no. 2, p. 206, February 2, 1928.

Tracing the life history I found difficulty, at first, in locating the eggs of the fly. Later, however, I discovered that they are

not placed down in the water pockets, as one might expect, but higher up on the leaf blade—at about the lower edge of the green area where it joins the white. The eggs are cigar shape and quite dark in color, about one-half millimeter in length. The incubation period lasts four days, when the larva splits the shell down over half its length, and crawls out. After feeding for twenty-eight to forty-five days the larvae pupate in the water pockets, and emerge as flies four days later. Thus the whole life cycle requires a period of only thirty-six to fifty-three days—and there is a continual series of development throughout the year.

Records of Immigrant Insects for 1933

BY THE EDITOR

The occurrence in Hawaii of the following immigrant insects is recorded for the first time in this issue. Those of the list marked with an asterisk were observed for the first time in the year 1933. The other species were already known to occur here, some of them for a number of years, but they had not been identified previously, and herein their names are used for the first time in Hawaiian literature. For details of records, etc., refer to the pages given.

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**Hunterellus hookeri* Howard. Parasite of dog tick. (Hym.)	360
**Eumerus* sp. Syrphid fly	361
**Leucaspis cockerelli* Green. Orchid scale	365
**Habrolepis* sp. (Hym.)	365
**Thripoctenus* sp. Thrips parasite	365
Pterolophia camura Newman. (Col.)	373
**Megalothorax minimum* Willem. (?) (Collembola)	375
**Eumerus* sp. Syrphid fly	375
**Protura* (Myrientomata)	378
**Exochus* sp. (?) (Hym.: Tryphoninae)	378
**Mesovelia mulsanti* White. (Hem.)	378
Pleurotropis wilderi (Howard). (Hym.)	379, 386
Omosita discoidea (Fab.). (Col.)	380
**Bythoscopus robustus* (Uhler). (Hom.)	381, 533
**Oligomerus obtusus* Leconte. (?) (Col.)	381
Parajapyx isabellae (Grassi). (Japygoidea)	382
**Pterostichus californicus* (Dej.) (Col.)	388
**Lema nigrovittata* Guerin. (Col.)	389
**Cecidomyid* (Diptera)	389
Neotrichus latiusculus (Fairm.) (Col.)	393
Acythopeus sp. Orchid weevil	393
**Heterodoxus longitarsus* Piaget. Kangaroo louse	394

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INDEX TO AUTHORS, EXHIBITORS AND PERSONS MENTIONED IN PAPERS OR DISCUSSIONS.

(Page references to papers are in black-faced type.)

INSECT INDEX BY ORDERS

(Popular names are in General Index.)

* Indicates genera, species, etc., new to science, the page on which each is described being indicated by black-faced type.

HYMENOPTERA

COLEOPTERA

DIPTERA

LEPIDOPTERA

HOMOPTERA

HETEROPTERA

ORTHOPTERA

DERMAPTERA

NEUROPTERA AND ODONATA

ISOPTERA (Termites)

THYSANOPTERA (Thrips)

CORRODENTIA (Psocids)

MISCELLANEOUS ANIMALS (NON-HEXAPODA)

GENERAL INDEX

PLANT INDEX

ERRATA AND CORRIGENDA

Vol. VIII.

Page 8, line 8, for "*Elusine*", read "*Eleusine*".
" 10, line 16, instead of "first record, etc.", read "Previously recorded from Molokai in 1927 (See Proc. Hawaiian Ent. Soc., VI, p. 395, 1927.)
" 31, line 19, for "*Celphalonomia*", read "*Cephalonomia*".
" 111, lines 21 and 22, for "*krauhniae*", read "*kraunhiae*".
" 112, line 19, for "*cyaneae*", read "*cyanea*".
" 117, line 17, for "*saccharriola*", read "*saccharicola*".
" 181, lines 15, 16, 17, for "*Xenocrabo*", read "*Xenocrabro*".
" 181, line 18, for "*Hylocrabo*", read "*Hylocrabro*".
" 181, line 19, for "*Nesocrabo*", read "*Nesocrabro*".
" 189, insert "HOMOPTERA" as line 22.
" 190, line 9 from bottom, author of **Anax strenuus** should be Hagen, not Perkins.
" 224, line 28, for "*uata*", read "*nata*".
" 228, line 12, for "*Latrodectus*", read "*Latrodectes*".
" 230, line 23, for "*albipuncta*", read "*albipunctata*".
" 321, line 8, read: "hind tibiae and femora with their hair mostly white."
" 330, add "femora" before 3rd line from bottom of page.
" 353, plate 23, fig. 35, by an error in drawing the second tarsal joint is nearly twice normal length.
" 381, line 9, for "*geniculatus*", read "*geniculata*".
" 411, line 19, for "*mamaki*", read "*mamake*".
" 424, line 8, for "*philippensis*", read "*philippinensis*".
" 449, line 8, for "*Sympyconinae*", read "*Sympycninae*".
" 493, line 7, for "*stigamtophora*", read "*stigmatophora*".
" 527, line 6 from bottom, for "*CXX*", read "*cxx*".
" 533, line 5, for "(*Timb.*)", read "(*Thunb.*)".
" 533, line 12, for "*Ashm.*", read "*How.*"
" 534, line 3, for "*occasioal*", read "*occasional*".